Elite Disc Drive

ST41097J

ST41201J

Reference Manual

(SMD Interface)

Seagate

WARNING

Do not attempt to install, operate, or repair the unit before you read the important safety information located after the table of contents in this manual. Failure to follow that and other safety precautions in this manual could cause injury to yourself and others.

Elite Disc Drive

ST41097J (97500-11G)
ST41201J (97500-12G)

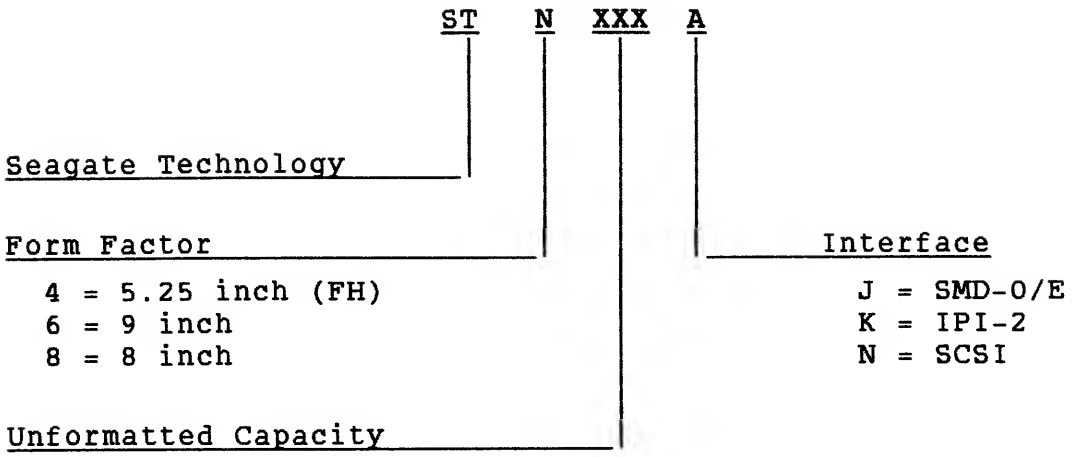
Reference Manual
(SMD Interface)

General Maintenance Information
Planning the System
Interface Functions

Publication Number: 83327290-A

Seagate

Seagate Disc Drive Product Numbers



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Minnetonka, MN 55343

We value your comments. A Comment Sheet is provided at the back of this manual.

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CONTENTS

FIGURES

TABLES

PREFACE

This manual is a reference book for users of the Seagate ST41097J and ST41201J Elite disc drives (employing the SMD interface). It supplements the information presented in the user's manual. It is intended to aid engineers who are designing subsystems using the drive and customer engineers who install and check out the drive. This manual should be used in conjunction with the user's manual.

The information in this manual is presented as follows:

Section 1 - General Maintenance Information. Contains information on warnings and precautions, maintenance tools and materials, testing the drive, and maintenance procedures.

Section 2 - Planning the System. Provides guidelines for proper airflow, describes how to set the sector switches, and discusses the various sweep cycle options.

Section 3 - Interface Functions. Describes the SMD-O and SMD-E interfaces: the signal lines, interface signal processing, and unit selection.

New features, technical changes, additions, and deletions in this manual are indicated as follows:

- A vertical bar in the outer margin of a page marks the changed area.
- A dot by the page number indicates the entire page contains new or changed information.
- A vertical bar by the page number indicates the information was moved from another page, but there were no technical or editorial changes.

The following manuals apply to the Elite disc drive. They are available from:

Seagate Technology, Inc.
Customer Services
12701 Whitewater Drive
Minnetonka, MN 55343

Phone: (612) 931-8612
Fax: (612) 931-8817

Publication No.	Title
83327280	ST41097J, ST41201J User's Manual (contains general description, installation procedures, operating instructions, parts data, and maintenance information)
83327290	ST41097J, ST41201J Reference Manual

For more information about the drive and interface described in this manual, you can request copies of the following specifications from your Seagate sales representative:

Specification No.	Title
64403300	Specification for Synchronized Spindle Systems
64403100	Product Specification for the ST41097J and ST41201J Elite Disc Drives
64712402	SMD-E Interface Specification

IMPORTANT SAFETY INFORMATION AND PRECAUTIONS

Use of proper safety and repair techniques is important for safe, reliable operation of this unit. Service should be done only by qualified persons. We recommend the procedures in this manual as effective ways of servicing the unit. Some procedures require the use of special tools. For proper maintenance and safety, you must use these tools as recommended.

The procedures in this manual and labels on the unit contain warnings and cautions that must be carefully read and followed to minimize or eliminate the risk of personal injury. The warnings point out conditions or practices that may endanger you or others. The cautions point out conditions or practices that may damage the unit, possibly making it unsafe for use.

You must also understand that these warnings and cautions are not exhaustive. We cannot possibly know, evaluate, and advise you of all the ways in which maintenance might be performed or the possible risk of each technique. Consequently, we have not completed any such broad evaluation. If you use a non-approved procedure or tool, first ensure that the method you choose will not risk either your safety or unit performance.

For the safety of yourself and others, observe the following warnings and precautions.

- Perform all maintenance by following the procedures in this manual.
- Follow all cautions and warnings in the procedures and on unit labels.
- Use sound safety practices when operating or repairing the unit.
- Use caution when troubleshooting a unit that has voltages present. Remove power from unit before servicing it.
- Wear safety shoes when removing or replacing heavy parts.
- In case of fire or other emergency, a means must be provided to isolate the drive from main power.
- When the drive is mounted in an equipment rack or cabinet, ensure that the internal temperature of the rack or cabinet will not exceed the limits defined for the drive. Where units are stacked vertically, pay special attention to the top where temperatures are usually highest.

- Follow the precautions listed under Electrostatic Discharge Protection in section 1 of this manual.

- Do not remove any circuit boards from the drive chassis. Return the entire drive for depot repair if any circuit board is defective. Removal of circuit boards by personnel not performing depot repair will damage components and may void the warranty.

- Do not remove the module from the drive chassis. Return the entire drive for depot repair if the module is defective.

- Do not attempt to disassemble the module. It is not field repairable. If the sealed module is opened by personnel not performing depot repair, this will damage components and void the warranty.

- As a component, this drive is designed to be installed and operated in accordance with UL1950, IEC380, IEC950, EN60950, CSA C22.2 154, CSA C22.2 220, and VDE0806. Refer to the user's manual for further information about installation.

- Always deenergize drive before removing or installing cables.

- If you do not use a recommended Seagate power supply, ensure the supply meets the specifications in this manual and is designed to be used in accordance with UL1950, IEC380, IEC950, EN60950, CSA C22.2 154, CSA C22.2 220, and VDE0806.

Use forced-air ventilation when bench-testing the drive to ensure proper cooling of drive components.

Section 1
General Maintenance Information

GENERAL MAINTENANCE INFORMATION 1

INTRODUCTION

This section contains general information relating to maintenance of the drive. You should be familiar with the information in this section and with drive operation before attempting any maintenance procedures. Information is divided into the following areas:

- Electrostatic Discharge Protection -- Provides instructions for the proper handling of electrostatically sensitive devices.
- Maintenance Tools and Materials -- Lists the tools and materials required to perform maintenance on the drive.
- Testing the Drive -- Provides information concerning the electrical testing of the drive, including a procedure for checking dc voltages supplied to the drive.
- Identifying Assemblies in the Drive -- Identifies the various parts of the drive.
- Maintenance Procedures -- Describes how to maintain the drive.

ELECTROSTATIC DISCHARGE PROTECTION

All drive electronic assemblies are sensitive to static electricity, due to the electrostatically sensitive devices used within the drive circuitry. Although some of these devices such as metal-oxide semiconductors are extremely sensitive, all semiconductors as well as some resistors and capacitors may be damaged or degraded by exposure to static electricity.

Electrostatic damage to electronic devices may be caused by a direct discharge of a charged conductor, or by exposure to the static fields surrounding charged objects. To avoid damage to drive electronic assemblies, service personnel must observe the following precautions when servicing the drive:

- Ground yourself to the drive whenever the drive electronics are or will be exposed. Connect yourself to ground with a wrist strap (refer to table 1-1 for part

numbers). Connection may be made to any grounded metal assembly. As a general rule, remember that you and the drive electronics must all be at ground potential to avoid potentially damaging static discharges.

- Turn off power before removing or installing the dc power cable.
- Do not remove any circuit boards from the drive.
- Never use an ohmmeter on any circuit boards.

> Removal of circuit boards by personnel not performing depot repair will damage components and may void the warranty.

MAINTENANCE TOOLS AND MATERIALS

The maintenance procedures described in this manual require the use of certain special tools, test equipment, and materials. These are listed in table 1-1 along with the appropriate Seagate part number. Note that the list includes only special tools. We assume that you have normal maintenance tools.

TABLE 1-1. MAINTENANCE TOOLS AND MATERIALS

Description	Seagate Part Number
Static Ground Wrist Straps	
6 1/2 to 8 inch wrist	12263496
up to 6 1/2 inch wrist	12263623
Volt/ohmmeter	Ballantine 345 or equivalent digital voltmeter

TESTING THE DRIVE

During testing and troubleshooting, the drive is normally required to perform various operations such as reading and writing test data. System software can be used to control the drive during these operations.

Following the discussion of testing methods, there is a procedure for checking dc voltages supplied to the drive.

DRIVE DIAGNOSTICS

The drive has built-in diagnostic tests. These diagnostic tests may be performed via the interface as described in section 3 of this manual.

SYSTEM SOFTWARE

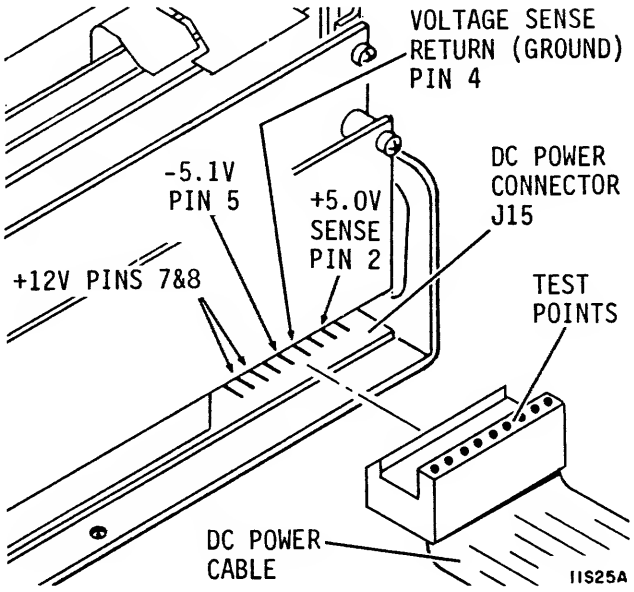
The drive may also be tested by use of system diagnostic test programs. This requires use of the controller and the appropriate software. In this type of testing, the drive communicates with the controller as in normal online operations, and special I/O connections are unnecessary.

Refer to manuals or other documentation applicable to the specific system or subsystem for information concerning the system software routines.

VOLTAGE CHECKS

The following procedure provides an overall check of the dc voltages used by the drive. Prior to performing this procedure, you should be familiar with the other information in this section and the safety information in the front of this manual.

The illustration to the right shows where the individual voltages appear on the drive's dc power connector (J15). Attach your test probe to test points located on the top surface of the dc cable connector.



1. Using system software, command continuous read/write operations with the drive on cylinder.

2. Connect the voltmeter ground lead to J15 - Pin 4 (Voltage Sense Return [Ground]).

3. Measure at the appropriate connection point to check the following voltages:

Voltage	Connection	Specification
+5.0 volt sense	J15 - Pin 1	+4.85 to +5.25 volts
-5.1 volts	J15 - Pin 5	-4.90 to -5.30 volts
+12 volts	J15 - Pins 7 & 8	+11.4 to +12.6 volts

IDENTIFYING ASSEMBLIES IN THE DRIVE

The major drive assemblies and components are shown on figure 1-1. Figure 1-2 shows the power supply that is available if desired by the customer for installation.

As shown on figure 1-1, the drive components are supported by a chassis. The module is shock-mounted on one end of the chassis and the circuit boards plug into a mother board attached to the other end of the chassis.

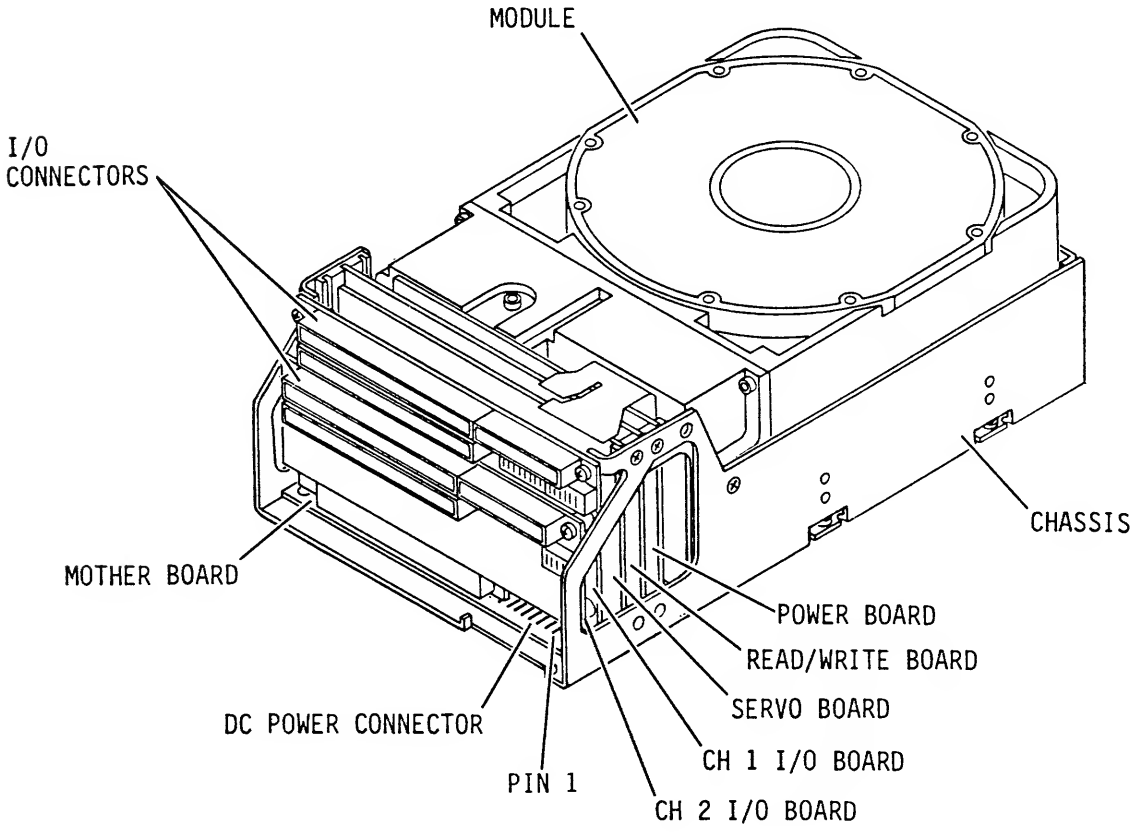


Figure 1-1. Drive Components

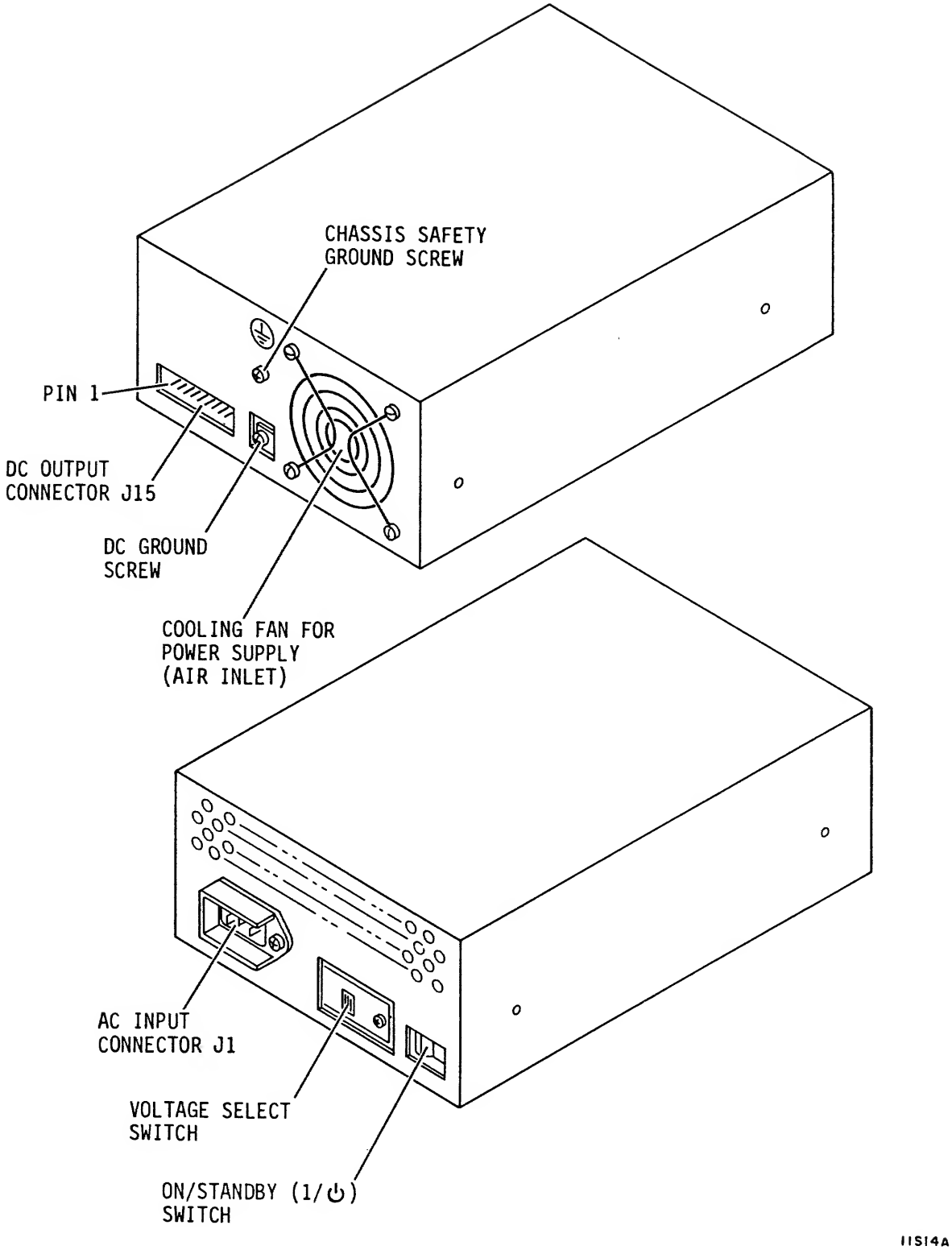


Figure 1-2. The Power Supply

MAINTENANCE PROCEDURES

This section contains the following maintenance information:

- Observing Maintenance Precautions
- Arranging for Depot Repair
- Removing and Replacing a Drive
- Removing and Replacing a Power Supply
- Packing a Drive for Shipment

OBSERVING MAINTENANCE PRECAUTIONS

Because the drive is depot-repairable, there are no field-replaceable parts. Before beginning any maintenance activities, observe the following precautions:

- Follow the precautions listed under Electrostatic Discharge Protection in the beginning of this section.
- Do not remove any circuit boards from the drive chassis. Return the entire drive for depot repair if any circuit board is defective. Removal of circuit boards by personnel not performing depot repair will damage components and may void the warranty.
- Do not remove the module from the drive chassis. Return the entire drive for depot repair if the module is defective.
- Do not attempt to disassemble the module. It is not field repairable. If the sealed module is opened by personnel not performing depot repair, this will damage components and void the warranty.
- Use forced-air ventilation when bench-testing the drive to ensure proper cooling of drive components.
- Do not connect or disconnect I/O cables while power is applied to the drive or controller.
- Do not connect or disconnect the dc power cable while the power supply is energized.

ARRANGING FOR DEPOT REPAIR

Before returning any units to Seagate, it is necessary to obtain a Returned Material Authorization (RMA) number. To get the number, you will need to know the part number and serial number of the unit. These numbers appear on a label located on the front surface of the module. Then contact:

Seagate Technology, Inc.
Customer Services
12701 Whitewater Drive
Minnetonka, MN 55343

Phone: 1-800-382-6060
Fax: (612) 931-8817

REMOVING AND REPLACING A DRIVE

CAUTION

When servicing the drive, observe all precautions listed under Electrostatic Discharge Protection in the beginning of this section. Failure to observe these precautions can result in serious damage to electronic assemblies.

To remove a drive for maintenance, perform the following steps:

1. Remove power from drive by setting On/Standby switch on power supply to Standby position.

2. Disconnect ac power cable from site power.

CAUTION

Remove terminators by hand. They could be damaged if a pliers or other tool is used.

3. Disconnect I/O cables, spindle sync cables (if used), terminators, and system ground strap from drive.

4. Disconnect dc power cable from dc power connector on drive.

5. Remove mounting screws that secure drive chassis to cabinet.

6. Carefully lift drive from its mounting, and move it to desired location.

To install a replacement drive, follow the procedures in section 2 of the user's manual.

REMOVING AND REPLACING A POWER SUPPLY

To remove a power supply for maintenance, perform the following steps:

1. Remove power from drive by setting On/Standby switch on power supply to Standby position.

2. Disconnect ac power cable from site power.

3. Disconnect dc power cable from dc power connector on power supply.

4. Remove chassis safety ground screw from power supply to disconnect ground strap.

5. Remove mounting screws that secure power supply to cabinet.

6. Carefully lift power supply from its mounting, and move it to desired location.

To install a replacement power supply, follow the procedures in section 2 of the user's manual.

PACKING A DRIVE FOR SHIPMENT

If it is necessary to ship the drive, repackage the drive with the original packaging materials (saved during installation). Comply with the manufacturer's packaging instructions to ensure that the drive will be undamaged in shipment. To obtain packaging instructions or a new shipping container, contact:

Seagate Technology, Inc.
Customer Services
12701 Whitewater Drive
Minnetonka, MN 55343

Phone: 1-800-382-6060
Fax: (612) 931-8817

When ordering packaging instructions or a new shipping container, specify the exact equipment number and series code of the drive as shown on the equipment identification label.

Section 2
Planning the System

PLANNING THE SYSTEM 2

INTRODUCTION

This section is provided to supplement the installation instructions presented in the user's manual. To aid in configuring the drive for specific system requirements, the following subjects are discussed:

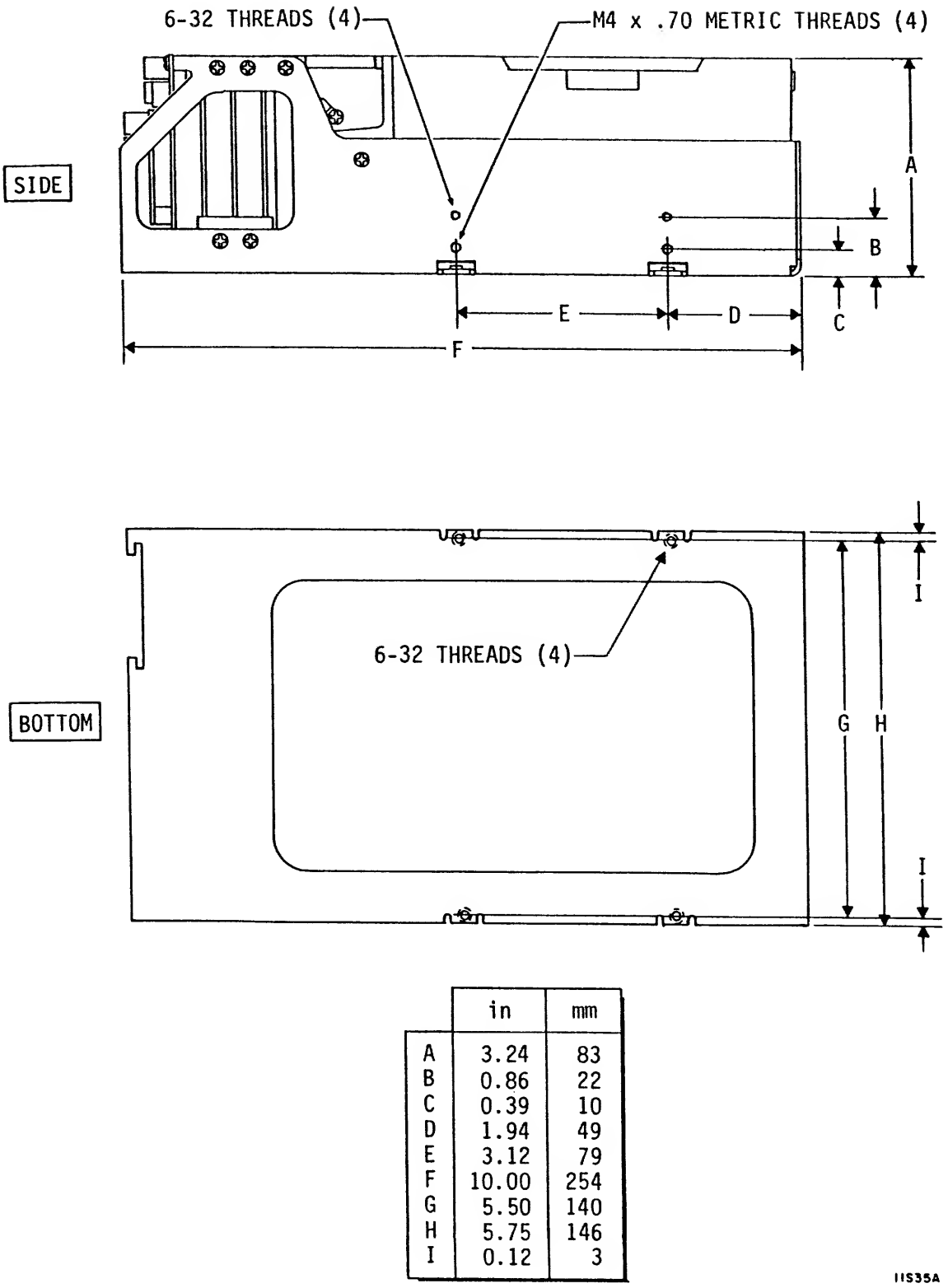
- Guidelines for Enclosure Design
- Guidelines for Proper Airflow
- Setting the Sector Switches
- Programming the Sweep Cycle Function

GUIDELINES FOR ENCLOSURE DESIGN

The drive is offered as a component to be installed in an enclosure designed by the customer. The enclosure design must provide for mounting of the drive and power supply, cable routing, and cooling. See the next topic for guidelines on providing proper cooling.

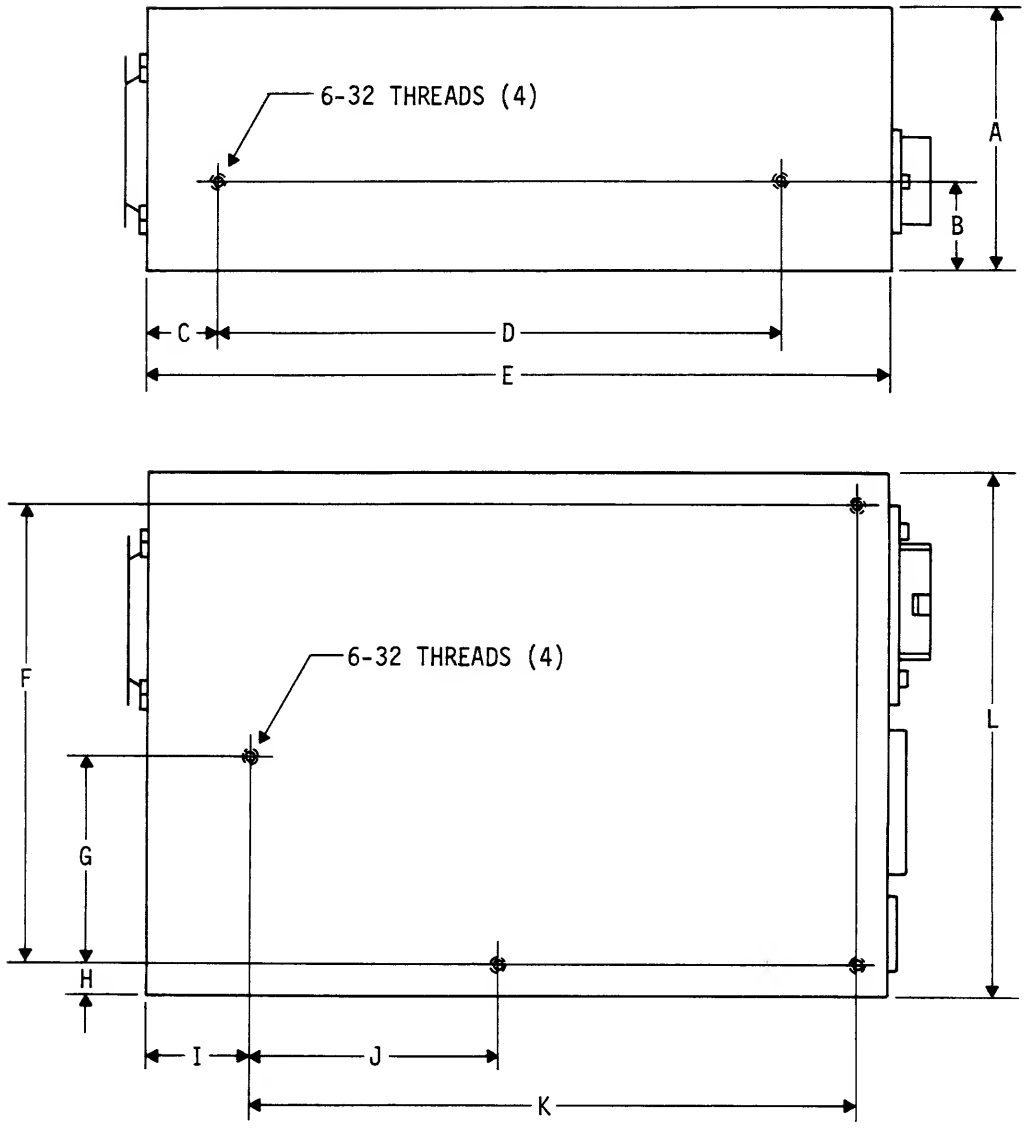
The system designer is responsible for obtaining any needed agency approvals such as FCC, UL, CSA, and VDE.

Figure 2-1 provides mounting dimensions for the drive. As described in the user's manual, the drive can be mounted using either side-mounting screws or bottom-mounting screws. Figure 2-2 provides similar information for the power supply. Like the drive, the power supply chassis has tapped holes in both the bottom surface and the two sides.



	in	mm
A	3.24	83
B	0.86	22
C	0.39	10
D	1.94	49
E	3.12	79
F	10.00	254
G	5.50	140
H	5.75	146
I	0.12	3

Figure 2-1. Drive Mounting Dimensions



	in	mm
A	2.75	70
B	0.95	24
C	0.80	20
D	6.00	152
E	8.00	202
F	4.90	124
G	2.20	56
H	0.335	9
I	1.11	28
J	2.675	68
K	6.55	166
L	5.57	141

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Figure 2-2. Power Supply Mounting Dimensions

GUIDELINES FOR PROPER AIRFLOW

The customer's enclosure design must ensure adequate cooling for the drive. Note that the fan in the power supply is intended for cooling only the power supply's internal parts.

The drive's product specification describes how to evaluate the airflow design. The evaluation consists of ensuring that the case temperatures of certain critical components remain acceptable during drive operation.

We recommend orienting the drive or directing the airflow in a way that creates the least amount of airflow resistance while providing airflow between the circuit boards and around the module. Also, choose the shortest possible path between the air inlet and exit. This minimizes the distance traveled by air that is heated by the drive and by other nearby heat sources.

Figure 2-3 shows the design approach with one or more fans placed alongside the drive adjacent to the circuit boards. The airflow patterns can be created by the fans either pushing or drawing air.

As shown in figure 2-3, it is possible to install a pair of drives side-by-side so that the air circulation ventilates both drives. This circulation can be created by one or more fans.

Figure 2-4 suggests how to proceed when the overall flow pattern is from front to back or from back to front. By using baffles, a portion of the overall airflow can be redirected through the space between the circuit boards.

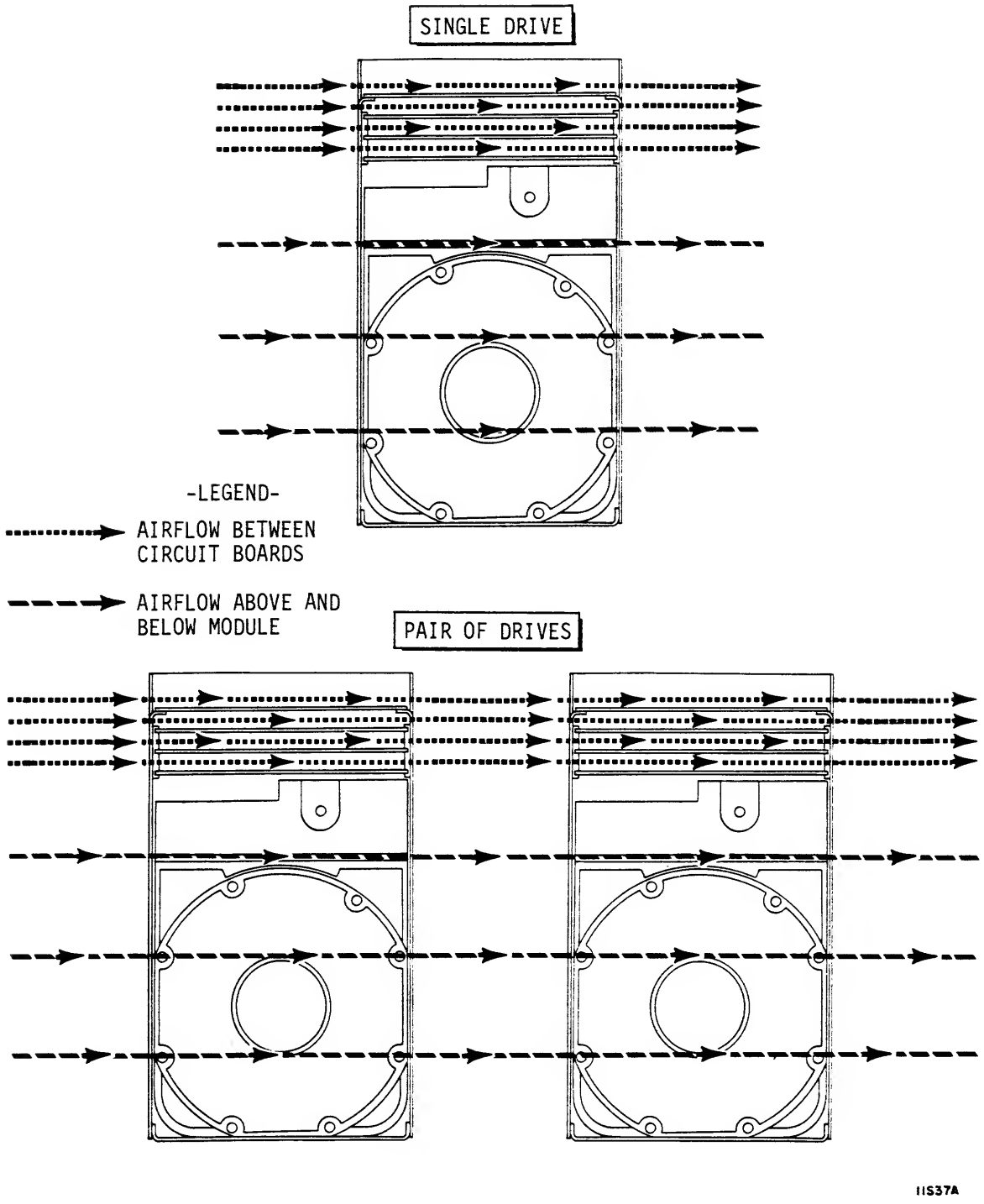


Figure 2-3. Perpendicular Airflow

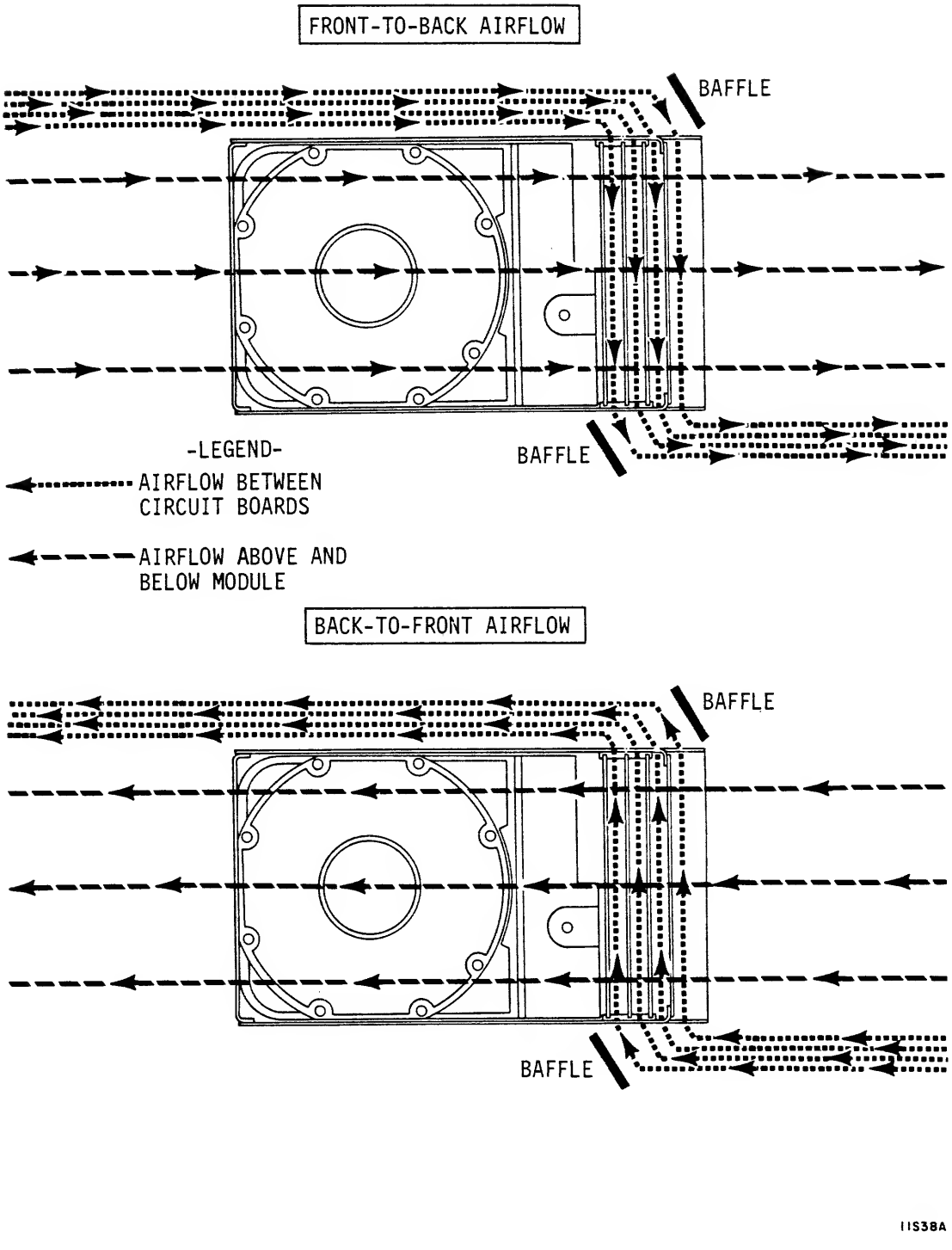


Figure 2-4. Lengthwise Airflow

SETTING THE SECTOR SWITCHES

The information in this topic supplements the instructions for sector selection given in the user's manual. The user's manual provides a procedure for calculating sector switch settings and sector length. For many installations the user's manual provides all the information required.

The information presented here is intended more for systems designers who are matching the drive's sector length to the nonstandard requirements of certain controllers. This information is organized as follows:

- Background Information
- Using a Table to Set the Switches
- Using Calculations to Set the Switches

Refer to the subsystem or controller reference manual to determine the number of sectors (or the bytes/sector) required by the controller. To achieve that requirement, the following settings are required:

- Sector switches
- Runt Sector switch.

Note that this information takes several different approaches to deriving appropriate switch settings. Use the approach that best suits your needs. For example, many users can use the sector switch table without concerning themselves with the calculations described after it.

The calculation approach is given, however, because some systems designers, when matching a disc drive to a specific controller, choose a sector length different from any given here in the table. In cases like this, the added material relates arbitrary sector lengths to switch settings.

BACKGROUND INFORMATION

The information in this topic discusses what the sector switches do, methods for deriving switch settings, and how to interpret the table of switch settings.

What the Sector Switches Do

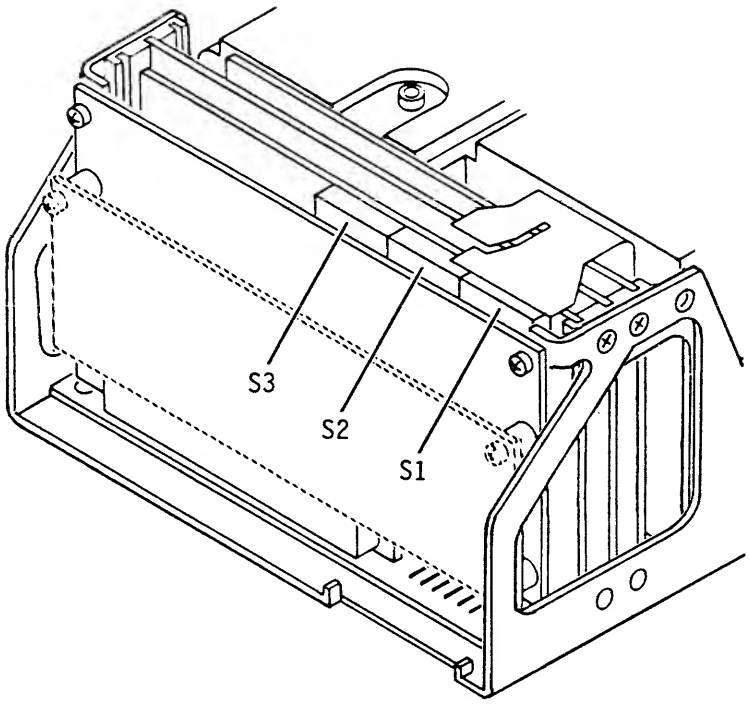
The sector switches supply a preset count to the sector counter circuit. This circuit counts sector clock pulses, starting at the preset value when index appears and after each new sector pulse is issued. When the sector counter has received a specific number of clock pulses, it issues another sector pulse and begins at the preset value to count again.

The individual sector switches are identified by their binary values. Figure 2-5 shows their location on the servo board. Each sector switch represents a binary and decimal value of clock pulses (as counted in the logic). The values related to each switch are as follows:

Binary Value	Decimal Value
2^0	1
2^1	2
2^2	4
2^3	8
2^4	16
2^5	32
2^6	64
2^7	128
2^8	256
2^9	512
2^{10}	1024
2^{11}	2048
2^{12}	4096
2^{13}	8192
2^{14}	16384

Round-down and Round-up Methods

The round-down and round-up methods appear as separate entries in the sector switch table and are mentioned in several of the calculation methods. The round-down and round-up methods produce differing results when the number of sector clock pulses per revolution is not evenly divisible by the number of sectors. The problem of an uneven division can be solved by methods of either rounding up or rounding down the result.

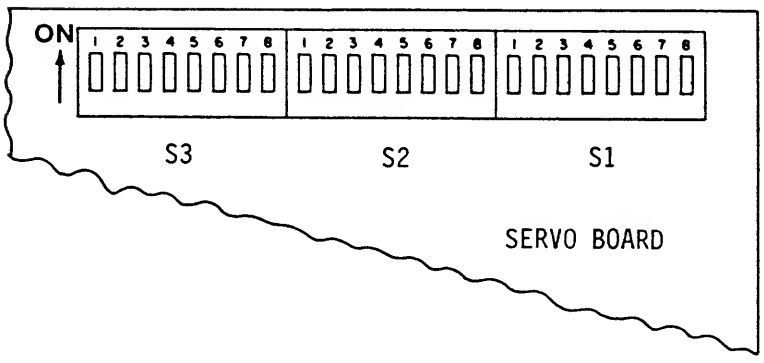


DIP SWITCH S3

1-SECTOR SWITCH 2^0 (1)
2-SECTOR SWITCH 2^1 (2)
3-SECTOR SWITCH 2^2 (4)
4-SECTOR SWITCH 2^3 (8)
5-SECTOR SWITCH 2^4 (16)
6-SECTOR SWITCH 2^5 (32)
7-SECTOR SWITCH 2^6 (64)
8-SECTOR SWITCH 2^7 (128)

DIP SWITCH S2

1-SECTOR SWITCH 2^8 (256)
2-SECTOR SWITCH 2^9 (512)
3-SECTOR SWITCH 2^{10} (1024)
4-SECTOR SWITCH 2^{11} (2048)
5-SECTOR SWITCH 2^{12} (4096)
6-SECTOR SWITCH 2^{13} (8192)
7-SECTOR SWITCH 2^{14} (16384)
8-RUNT SECTOR



DIP SWITCH S1

1-SWEEP CYCLE ENABLE
2-ENABLE SWEEP ONLY ON SEEKS
3-MANUFACTURING TEST
4-WRITE ENABLE
5-UNIT SELECT 2^0
6-UNIT SELECT 2^1
7-UNIT SELECT 2^2
8-UNIT SELECT 2^3

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Figure 2-5. Servo Board Switches

For both methods, the tables of sector switch settings (which appear later in this section) list the bytes in normal (full-length) sectors and provide the required settings of the sector switches for a given sector length. Figure 2-6 uses examples for the ST41201J drive of 63 sectors (an uneven division) and 64 sectors (an even division) to show how the two methods differ. It also shows the entries in the switch settings table for these cases. These tables list the results for the round-down and round-up methods on separate lines. Figure 2-7 defines the entries in the switch settings tables.

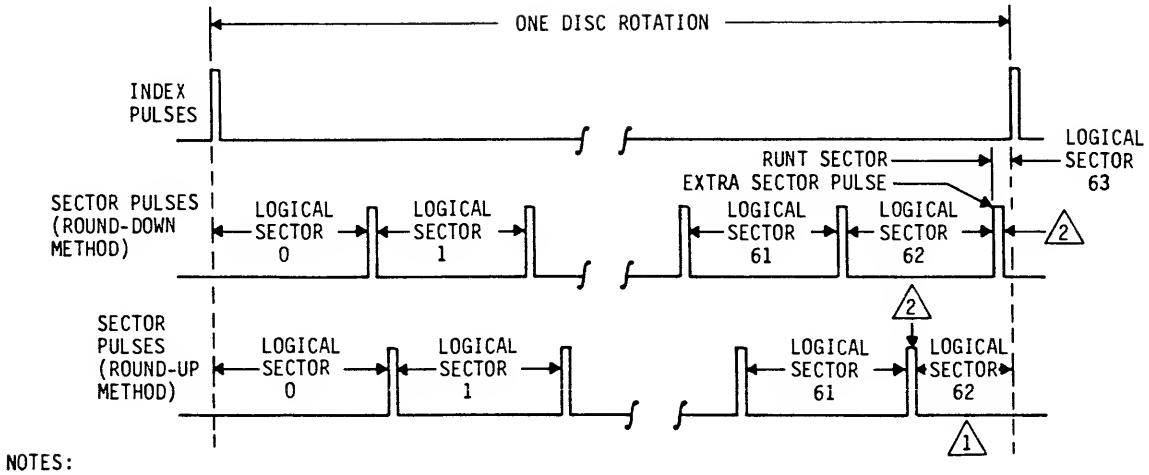
The round-down method produces a runt sector if there is an uneven division. A runt sector is a short interval following the last normal-length sector. If there is a runt sector, the tables identify its logical sector number and list the byte length of the runt sector. When a runt sector occurs, it is preceded by an extra sector pulse. The topic Runt Suppression describes how this extra sector pulse can be eliminated.

The round-up method produces a short last sector if there is an uneven division. If the last sector on the track is shorter than the normal sectors, the tables identify its logical sector number and its length in bytes. There is no runt sector (or extra sector pulse), however.

For the example of 63 sectors, the number of sector clock pulses per revolution is not evenly divisible by the number of sectors. The round-up and round-down methods produce different results, both in terms of sector lengths and in the presence or absence of an extra sector pulse.

For the example of 64 sectors, the number of sector clock pulses per revolution is evenly divisible by the number of sectors. The round-up and round-down methods produce the same sector length, normal sectors of 525 bytes. In this case, the two methods call for identical switch settings. No runt sector (round-down method) or short sector (round-up method) is indicated.

EXAMPLE: 63 SECTORS

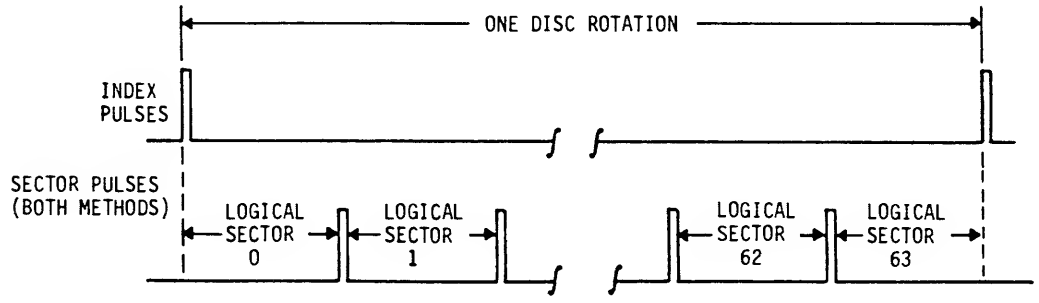


NOTES:

1. WITH ROUND-UP METHOD, LAST SECTOR MAY BE SHORTER THAN NORMAL SECTORS.
2. PLACING "RUNT SECTOR" SWITCH IN ON POSITION SUPPRESSES SECTOR PULSE PRECEDING SHORT LAST SECTOR.

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR/LENGTH	RUNT SECTOR/LENGTH	SWITCH SETTINGS LSB MSB
63	RND-DWN RND-UP	533.00 533.50	62L / 523.0	63L / 21.00	C O O C O C O O O O C O O O O O C O C O C O O O O C O O O O

EXAMPLE: 64 SECTORS



SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR/LENGTH	RUNT SECTOR/LENGTH	SWITCH SETTINGS LSB MSB
64	RND-DWN RND-UP	525.00 525.00			C O O C C O O O O O C O O O O C O O C C O O O O O C O O O O

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Figure 2-6. Round-Down and Round-Up Methods

Column Name	Meaning
Sector Number	The number of sectors desired. Example: 63 sectors corresponds to logical sectors 0 through 62.
Method Used	RND-DWN = Round-Down Method RND-UP = Round-Up Method
Normal Sector	The length in bytes of all full-length sectors.
Short Sector/ Length*	(Used for Round-Up Method only) If space is blank, all logical sectors have normal length, and there is no short last sector (see example for 64 sectors). If space has an entry, it lists the logical sector number of the short last sector (62L in example for 63 sectors) and its length in bytes (523.00 in same example).
Runt Sector/ Length*	(Used for Round-Down Method only) If space is blank, there is no runt sector (see example for 64 sectors). If space has an entry, it lists the logical sector number of the runt sector (63L in example for 63 sectors) and its length in bytes (21.00 in same example).
Switch Settings	Ranging from LSB (Least Significant Bit -- set by Switch 2^0) to MSB (Most Significant Bit -- set by Switch 2^{14}) O = Open (Off) C = Closed (On)

* If the Runt Sector switch is closed (on), the sector pulse preceding a runt sector or short sector is suppressed.

Figure 2-7. Table Definitions

Runt Suppression

Runt suppression may or may not be desirable. Runt sector pulses are suppressed when the Runt Sector switch is closed (on). Consider the examples given in figure 2-6.

Selecting runt suppression defeats the purpose of using the round-up method. Referring to the example of 63 sectors, the 523.00-byte (shorter) last sector (logical sector 62) would no longer be preceded by a sector pulse and would not be available for use.

Depending on the controller requirements, runt suppression may improve operation with the round-down method. If runt suppression had been selected in the example of 63 sectors, the runt sector would no longer exist. With no extra sector pulse, logical sector 62 would be extended by 21.00 bytes.

If runt suppression had been selected in the example of 64 sectors, it would have no effect. The last sector pulse is suppressed only when if the last sector is shorter than the normal sectors.

USING A TABLE TO SET THE SWITCHES

Table 2-1 lists standard settings for the sector switches on the ST41097J drive (22.1 MHz transfer rate). Table 2-2 provides the same information for the ST41201J drive (24.2 MHz transfer rate). The individual entries in the tables are described earlier in this topic in figures 2-6 and 2-7. Across from the number of sectors listed in each sector switch setting table is a row of Cs and Os. C represents the Closed (On) position of the sector switch. O represents the Open (Off) position of the sector switch. Set the switches to the positions designated in the appropriate table.

For future reference, you may want to record the switch settings you made. Use the following worksheet:

Number of Sectors: _____

Switch Settings:

2^0 __	2^1 __	2^2 __	2^3 __	2^4 __
2^5 __	2^6 __	2^7 __	2^8 __	2^9 __
2^{10} __	2^{11} __	2^{12} __	2^{13} __	2^{14} __

Runt Sector switch: On __ Off __

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
1	RND-DWN	30720.00			C C C C C C C C C C C C C C C C
	RND-UP	30720.00			C C C C C C C C C C C C C C C C
2	RND-DWN	15360.00			C C C C C C C C C C C O C C C C
	RND-UP	15360.00			C C C C C C C C C C C O C C C C
3	RND-DWN	10240.00			C C C C C C C C C C C C O O C C
	RND-UP	10240.00			C C C C C C C C C C C C O O C C
4	RND-DWN	7680.00			C C C C C C C C C C O C C C O C
	RND-UP	7680.00			C C C C C C C C C C O C C C O C
5	RND-DWN	6144.00			C C C C C C C C C C C C O C O C
	RND-UP	6144.00			C C C C C C C C C C C C O C O C
6	RND-DWN	5120.00			C C C C C C C C C C C C O O C O
	RND-UP	5120.00			C C C C C C C C C C C C O O C O
7	RND-DWN	4388.50		7L / 0.50	O O O C O O C O O C O O O C O
	RND-UP	4389.00	6L / 4386.00		C O O C O O C O O C O O O C O
8	RND-DWN	3840.00			C C C C C C C C C O C C C O O
	RND-UP	3840.00			C C C C C C C C C C O C C O O
9	RND-DWN	3413.00		9L / 3.00	C O O C O C O C O C O C C O O
	RND-UP	3413.50	8L / 3412.00		O C O C O C O C O C O C C O O
10	RND-DWN	3072.00			C C C C C C C C C C C C O C O O
	RND-UP	3072.00			C C C C C C C C C C C C O C O O
11	RND-DWN	2792.50		11L / 2.50	O O O O C O C C C O C O C O O
	RND-UP	2793.00	10L / 2790.00		C O O O C O C C C O C O C O O
12	RND-DWN	2560.00			C C C C C C C C C C C O O C O O
	RND-UP	2560.00			C C C C C C C C C C C O O C O O
13	RND-DWN	2363.00		13L / 1.00	C O C O C C C O O C O O C O O
	RND-UP	2363.50	12L / 2358.00		O C C O C C C O O C O O C O O
14	RND-DWN	2194.00		14L / 4.00	C C O O O C O O C O O O C O O
	RND-UP	2194.50	13L / 2191.50		O O C O O C O O C O O O C O O
15	RND-DWN	2048.00			C C C C C C C C C C C C O O O
	RND-UP	2048.00			C C C C C C C C C C C C O O O
16	RND-DWN	1920.00			C C C C C C C C C O C C C O O O
	RND-UP	1920.00			C C C C C C C C C O C C C O O O
17	RND-DWN	1807.00		17L / 1.00	C O C C C O O O O C C C O O O
	RND-UP	1807.50	16L / 1800.00		O C C C C O O O O C C C O O O
18	RND-DWN	1706.50		18L / 3.00	O O C O C O C O C O C C O O O
	RND-UP	1707.00	17L / 1701.00		C O C O C O C O C O C C O O O
19	RND-DWN	1616.50		19L / 6.50	O O O O O C O C O O C C O O O
	RND-UP	1617.00	18L / 1614.00		C O O O O C O C O O C C O O O
20	RND-DWN	1536.00			C C C C C C C C C C C O C O O O
	RND-UP	1536.00			C C C C C C C C C C C O C O O O
21	RND-DWN	1462.50		21L / 7.50	O O C C O C C O C C O C O O O
	RND-UP	1463.00	20L / 1460.00		C O C C O C C O C C O C O O O
22	RND-DWN	1396.00		22L / 8.00	C C C O O C C C O C O C O O O
	RND-UP	1396.50	21L / 1393.50		O O O C O C C C O C O C O O O
23	RND-DWN	1335.50		23L / 3.50	O C C C O C C O O C O C O O O
	RND-UP	1336.00	22L / 1328.00		C C C C O C C O O C O C O O O
24	RND-DWN	1280.00			C C C C C C C C C O O C O O O
	RND-UP	1280.00			C C C C C C C C C C O O C O O O

Continued

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
25	RND-DWN RND-UP	1228.50 1229.00	24L / 1224.00	25L / 7.50	O O O C C O O C C O O C O O O C O O C C O O C C O O C O O O
26	RND-DWN RND-UP	1181.50 1182.00	25L / 1170.00	26L / 1.00	O C O C C C O O C O O C O O O C C O C C C O O C O O C O O O
27	RND-DWN RND-UP	1137.50 1138.00	26L / 1132.00	27L / 7.50	O C O O O C C C O O O C O O O C C O O O C C C O O O C O O O
28	RND-DWN RND-UP	1097.00 1097.50	27L / 1087.50	28L / 4.00	C O O O C O O C O O O C O O O O C O O C O O C O O O C O O O
29	RND-DWN RND-UP	1059.00 1059.50	28L / 1054.00	29L / 9.00	C O C O O O C O O O O C O O O O C C O O O C O O O O C O O O
30	RND-DWN RND-UP	1024.00 1024.00			C C C C C C C C C C C O O O O C C C C C C C C C C C O O O O
31	RND-DWN RND-UP	990.50 991.00	30L / 990.00	31L / 14.50	O O C C C C O C C C C O O O O C O C C C C O C C C C O O O O
32	RND-DWN RND-UP	960.00 960.00			C C C C C C C O C C C O O O O C C C C C C C O C C C O O O O
33	RND-DWN RND-UP	930.50 931.00	32L / 928.00	33L / 13.50	O O C O O O C O C C C O O O O C O C O O O C O C C C O O O O
34	RND-DWN RND-UP	903.50 904.00	33L / 888.00	34L / 1.00	O C C C O O O O C C C O O O O C C C C O O O O C C C O O O O
35	RND-DWN RND-UP	877.50 878.00	34L / 868.00	35L / 7.50	O C O C C O C C O C C O O O O C C O C C O C C O C C O O O O
36	RND-DWN RND-UP	853.00 853.50	35L / 847.50	36L / 12.00	C O O C O C O C O C C O O O O O C O C O C O C O C C O O O O
37	RND-DWN RND-UP	830.00 830.50	36L / 822.00	37L / 10.00	C C O C C C C O O C C O O O O O O C C C C C O O C C O O O O
38	RND-DWN RND-UP	808.00 808.50	37L / 805.50	38L / 16.00	C C C C O O C O O C C O O O O O O O O C O C O O C C O O O O
39	RND-DWN RND-UP	787.50 788.00	38L / 776.00	39L / 7.50	O C C O O C O O O C C O O O O C C C O O C O O O C C O O O O
40	RND-DWN RND-UP	768.00 768.00			C C C C C C C C C O C O O O O C C C C C C C C C O C O O O O
41	RND-DWN RND-UP	749.00 749.50	40L / 740.00	41L / 11.00	C O O C C O C C C O C O O O O O C O C C O C C C O C O O O O
42	RND-DWN RND-UP	731.00 731.50	41L / 728.50	42L / 18.00	C O C O C C O C C O C O O O O O C C O C C O C C O C O O O O
43	RND-DWN RND-UP	714.00 714.50	42L / 711.00	43L / 18.00	C C O O C O O C C O C O O O O O O C O C O O C C O C O O O O
44	RND-DWN RND-UP	698.00 698.50	43L / 684.50	44L / 8.00	C C O O C C C O C O C O O O O O O C O C C C O C O C O O O O
45	RND-DWN RND-UP	682.50 683.00	44L / 668.00	45L / 7.50	O O C O C O C O C O C O O O O C O C O C O C O C O C O O O O
46	RND-DWN RND-UP	667.50 668.00	45L / 660.00	46L / 15.00	O C C O C C O O C O C O O O O C C C O C C O O C O C O O O O
47	RND-DWN RND-UP	653.50 654.00	46L / 636.00	47L / 5.50	O C O C C O O O C O C O O O O C C O C C O O O C O C O O O O
48	RND-DWN RND-UP	640.00 640.00			C C C C C C C C C O O C O O O O C C C C C C C C C O O C O O O O

Continued

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
49	RND-DWN RND-UP	626.50 627.00	48L / 624.00	49L / 21.50	O O C O O C C C O O C O O O O C O C O O C C C O O C O O O O
50	RND-DWN RND-UP	614.00 614.50	49L / 609.50	50L / 20.00	C C O C O O C C O O C O O O O O O C C O O C C O O C O O O O
51	RND-DWN RND-UP	602.00 602.50	50L / 595.00	51L / 18.00	C C O O C C O C O O C O O O O O O C O C C O C O O C O O O O
52	RND-DWN RND-UP	590.50 591.00	51L / 579.00	52L / 14.00	O O C C C O O C O O C O O O O C O C C C O O C O O C O O O O
53	RND-DWN RND-UP	579.50 580.00	52L / 560.00	53L / 6.50	O C C O O O O C O O C O O O O C C C O O O O C O O C O O O O
54	RND-DWN RND-UP	568.50 569.00	53L / 563.00	54L / 21.00	O O O O C C C O O O C O O O O C O O O C C C O O O C O O O O
55	RND-DWN RND-UP	558.50 559.00	54L / 534.00	55L / 2.50	O O C C C O C O O O C O O O O C O C C C O C O O O C O O O O
56	RND-DWN RND-UP	548.50 549.00	55L / 525.00	56L / 4.00	O O O C O O C O O O C O O O O C O O C O O C O O O C O O O O
57	RND-DWN RND-UP	538.50 539.00	56L / 536.00	57L / 25.50	O O C O C C O O O O C O O O O C O C O C C O O O O C O O O O
58	RND-DWN RND-UP	529.50 530.00	57L / 510.00	58L / 9.00	O C O O O C O O O O C O O O O C C O O O C O O O O C O O O O
59	RND-DWN RND-UP	520.50 521.00	58L / 502.00	59L / 10.50	O O O O C O O O O O C O O O O C O O O C O O O O O C O O O O
60	RND-DWN RND-UP	512.00 512.00			C C C C C C C C C C O O O O O C C C C C C C C C C O O O O O
61	RND-DWN RND-UP	503.50 504.00	60L / 480.00	61L / 6.50	O C C C O C C C C C O O O O O C C C C O C C C C C O O O O O
62	RND-DWN RND-UP	495.00 495.50	61L / 494.50	62L / 30.00	C O C C C O C C C C O O O O O O C C C C O C C C C O O O O O
63	RND-DWN RND-UP	487.50 488.00	62L / 464.00	63L / 7.50	O C C C O O C C C C O O O O O C C C C O O C C C C O O O O O
64	RND-DWN RND-UP	480.00 480.00			C C C C C C C O C C C O O O O O C C C C C C C O C C C O O O O O
65	RND-DWN RND-UP	472.50 473.00	64L / 448.00	65L / 7.50	O O O O C C O C C C O O O O O C O O O C C O C C C O O O O O
66	RND-DWN RND-UP	465.00 465.50	65L / 462.50	66L / 30.00	C O O O O C O C C C O O O O O O C O O O C O C C C O O O O O
67	RND-DWN RND-UP	458.50 459.00	66L / 426.00	67L / 0.50	O O C O C O O C C C O O O O O C O C O C O O C C C O O O O O
68	RND-DWN RND-UP	451.50 452.00	67L / 436.00	68L / 18.00	O C C O O O O C C C O O O O O C C C O O O O C C C O O O O O
69	RND-DWN RND-UP	445.00 445.50	68L / 426.00	69L / 15.00	C O O C C C C O C C O O O O O O C O C C C C O C C O O O O O
70	RND-DWN RND-UP	438.50 439.00	69L / 429.00	70L / 25.00	O O C C O C C O C C O O O O O C O C C O C C O C C O O O O O
71	RND-DWN RND-UP	432.50 433.00	70L / 410.00	71L / 12.50	O O O O O C C O C C O O O O O C O O O O C C O C C O O O O O
72	RND-DWN RND-UP	426.50 427.00	71L / 403.00	72L / 12.00	O O C O C O C O C C O O O O O C O C O C O C O C C O O O O O

Continued

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
73	RND-DWN RND-UP	420.50 421.00	72L / 408.00	73L / 23.50	O O O C O O C O C C O O O O O C O O C O O C O C C O O O O O
74	RND-DWN RND-UP	415.00 415.50	73L / 388.50	74L / 10.00	C O C C C C C O O C C O O O O O O C C C C C C O O C C O O O O O
75	RND-DWN RND-UP	409.50 410.00	74L / 380.00	75L / 7.50	O C O O C C O O C C O O O O O C C O O C C O O C C O O O O O
76	RND-DWN RND-UP	404.00 404.50	75L / 382.50	76L / 16.00	C C C O O C O O C C O O O O O O O O C O C O O C C O O O O O
77	RND-DWN RND-UP	398.50 399.00	76L / 396.00	77L / 35.50	O O C C C O O O C C O O O O O C O C C C O O O C C O O O O O
78	RND-DWN RND-UP	393.50 394.00	77L / 382.00	78L / 27.00	O C O O C O O O C C O O O O O C C O O C O O O C C O O O O O
79	RND-DWN RND-UP	388.50 389.00	78L / 378.00	79L / 28.50	O O O C O O O O C C O O O O O C O O C O O O O C C O O O O O
80	RND-DWN RND-UP	384.00 384.00			C C C C C C C C C O C O O O O O C C C C C C C C C O C O O O O O
81	RND-DWN RND-UP	379.00 379.50	80L / 360.00	81L / 21.00	C O C O C C C C O C O O O O O O C C O C C C C O C O O O O O
82	RND-DWN RND-UP	374.50 375.00	81L / 345.00	82L / 11.00	O O C C O C C C O C O O O O O C O C C O C C C O C O O O O O
83	RND-DWN RND-UP	370.00 370.50	82L / 339.00	83L / 10.00	C C O O O C C C O C O O O O O O O C O O C C C O C O O O O O
84	RND-DWN RND-UP	365.50 366.00	83L / 342.00	84L / 18.00	O C O C C O C C O C O O O O O C C O C C O C C O C O O O O O
85	RND-DWN RND-UP	361.00 361.50	84L / 354.00	85L / 35.00	C O O O C O C C O C O O O O O O C O O C O C C O C O O O O O
86	RND-DWN RND-UP	357.00 357.50	85L / 332.50	86L / 18.00	C O O C O O C C O C O O O O O O C O C O O C C O C O O O O O
87	RND-DWN RND-UP	353.00 353.50	86L / 319.00	87L / 9.00	C O O O O O C C O C O O O O O O C O O O O C C O C O O O O O
88	RND-DWN RND-UP	349.00 349.50	87L / 313.50	88L / 8.00	C O O C C C O C O C O O O O O O C O C C C O C O C O O O O O
89	RND-DWN RND-UP	345.00 345.50	88L / 316.00	89L / 15.00	C O O O C C O C O C O O O O O O C O O C C O C O C O O O O O
90	RND-DWN RND-UP	341.00 341.50	89L / 326.50	90L / 30.00	C O O C O C O C O C O O O O O O C O C O C O C O C O O O O O
91	RND-DWN RND-UP	337.50 338.00	90L / 300.00	91L / 7.50	O C O O O C O C O C O O O O O C C O O O C O C O C O O O O O
92	RND-DWN RND-UP	333.50 334.00	91L / 326.00	92L / 38.00	O C O C C O O C O C O O O O O C C O C C O O C O C O O O O O
93	RND-DWN RND-UP	330.00 330.50	92L / 314.00	93L / 30.00	C C O O C O O C O C O O O O O O O C O C O O C O C O O O O O
94	RND-DWN RND-UP	326.50 327.00	93L / 309.00	94L / 29.00	O O C C O O O C O C O O O O O C O C C O O O C O C O O O O O
95	RND-DWN RND-UP	323.00 323.50	94L / 311.00	95L / 35.00	C O C O O O O C O C O O O O O O C C O O O O C O C O O O O O
96	RND-DWN RND-UP	320.00 320.00			C C C C C C C C O O C O O O O O C C C C C C C C O O C O O O O O

Continued

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
97	RND-DWN RND-UP	316.50 317.00	96L / 288.00	97L / 19.50	O O O C C C C O O C O O O O O C O O C C C C O O C O O O O O
98	RND-DWN RND-UP	313.00 313.50	97L / 310.50	98L / 46.00	C O O O C C C O O C O O O O O O C O O C C C O O C O O O O O
99	RND-DWN RND-UP	310.00 310.50	98L / 291.00	99L / 30.00	C C O C O C C O O C O O O O O O O C C O C C O O C O O O O O
100	RND-DWN RND-UP	307.00 307.50	99L / 277.50	100L / 20.00	C O C O O C C O O C O O O O O O C C O O C C O O C O O O O O
101	RND-DWN RND-UP	304.00 304.50	100L / 270.00	101L / 16.00	C C C C C O C O O C O O O O O O O O O O C C O O C O O O O O
102	RND-DWN RND-UP	301.00 301.50	101L / 268.50	102L / 18.00	C O O C C O C O O C O O O O O O C O C C O C O O C O O O O O
103	RND-DWN RND-UP	298.00 298.50	102L / 273.00	103L / 26.00	C C O O C O C O O C O O O O O O O C O C O C O O C O O O O O
104	RND-DWN RND-UP	295.00 295.50	103L / 283.50	104L / 40.00	C O C C O O C O O C O O O O O O C C C O O C O O C O O O O O
105	RND-DWN RND-UP	292.50 293.00	104L / 248.00	105L / 7.50	O O O C O O C O O C O O O O O C O O C O O C O O C O O O O O
106	RND-DWN RND-UP	289.50 290.00	105L / 270.00	106L / 33.00	O C O O O O C O O C O O O O O C C O O O O C O O C O O O O O
107	RND-DWN RND-UP	287.00 287.50	106L / 245.00	107L / 11.00	C O C C C C O O O C O O O O O O C C C C C O O O C O O O O O
108	RND-DWN RND-UP	284.00 284.50	107L / 278.50	108L / 48.00	C C C O C C O O O C O O O O O O O O C C C O O O C O O O O O
109	RND-DWN RND-UP	281.50 282.00	108L / 264.00	109L / 36.50	O C O O C C O O O C O O O O O C C O O C C O O O C O O O O O
110	RND-DWN RND-UP	279.00 279.50	109L / 254.50	110L / 30.00	C O C C O C O O O C O O O O O O C C C O C O O O C O O O O O
111	RND-DWN RND-UP	276.50 277.00	110L / 250.00	111L / 28.50	O O O C O C O O O C O O O O O C O O C O C O O O C O O O O O
112	RND-DWN RND-UP	274.00 274.50	111L / 250.50	112L / 32.00	C C O O O C O O O C O O O O O O O C O O C O O O C O O O O O
113	RND-DWN RND-UP	271.50 272.00	112L / 256.00	113L / 40.50	O C C C C C O O O C O O O O O C C C C C C O O O C O O O O O
114	RND-DWN RND-UP	269.00 269.50	113L / 266.50	114L / 54.00	C O O C C O O O O C O O O O O O C O C C O O O O C O O O O O
115	RND-DWN RND-UP	267.00 267.50	114L / 225.00	115L / 15.00	C O C O C O O O O C O O O O O O C C O C O O O O C O O O O O
116	RND-DWN RND-UP	264.50 265.00	115L / 245.00	116L / 38.00	O O O O C O O O O C O O O O O C O O O C O O O O C O O O O O
117	RND-DWN RND-UP	262.50 263.00	116L / 212.00	117L / 7.50	O O C C O O O O O C O O O O O C O C C O O O O O C O O O O O
118	RND-DWN RND-UP	260.00 260.50	117L / 241.50	118L / 40.00	C C C O O O O O O C O O O O O O O O C O O O O O C O O O O O
119	RND-DWN RND-UP	258.00 258.50	118L / 217.00	119L / 18.00	C C O O O O O O O C O O O O O O O C O O O O O O C O O O O O
120	RND-DWN RND-UP	256.00 256.00			C C C C C C C C C O O O O O O O C C C C C C C C C O O O O O O O

Continued

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
121	RND-DWN RND-UP	253.50 254.00	120L / 240.00	121L / 46.50	O C O C C C C C C O O O O O O O C C O C C C C C C O O O O O O O
122	RND-DWN RND-UP	251.50 252.00	121L / 228.00	122L / 37.00	O C C O C C C C C O O O O O O O C C C O C C C C C O O O O O O O
123	RND-DWN RND-UP	249.50 250.00	122L / 220.00	123L / 31.50	O C O O C C C C C O O O O O O O C C O O C C C C C O O O O O O O
124	RND-DWN RND-UP	247.50 248.00	123L / 216.00	124L / 30.00	O C C C O C C C C O O O O O O O C C C C O C C C C O O O O O O O
125	RND-DWN RND-UP	245.50 246.00	124L / 216.00	125L / 32.50	O C O C O C C C C O O O O O O O C C O C O C C C C O O O O O O O
126	RND-DWN RND-UP	243.50 244.00	125L / 220.00	126L / 39.00	O C C O O C C C C O O O O O O O C C C O O C C C C O O O O O O O
127	RND-DWN RND-UP	241.50 242.00	126L / 228.00	127L / 49.50	O C O O O C C C C O O O O O O O C C O O O C C C C O O O O O O O
128	RND-DWN RND-UP	240.00 240.00			C C C C C O C C C O O O O O O O C C C C C O C C C O O O O O O O
129	RND-DWN RND-UP	238.00 238.50	128L / 192.00	129L / 18.00	C C O C C O C C C O O O O O O O O O C C C O C C C O O O O O O O
130	RND-DWN RND-UP	236.00 236.50	129L / 211.50	130L / 40.00	C C C O C O C C C O O O O O O O O O O C C O C C C O O O O O O O
131	RND-DWN RND-UP	234.50 235.00	130L / 170.00	131L / 0.50	O O C O C O C C C O O O O O O O C O C O C O C C C O O O O O O O
132	RND-DWN RND-UP	232.50 233.00	131L / 197.00	132L / 30.00	O O O O C O C C C O O O O O O O C O O O C O C C C O O O O O O O
133	RND-DWN RND-UP	230.50 231.00	132L / 228.00	133L / 63.50	O O C C O O C C C O O O O O O O C O C C O O C C C O O O O O O O
134	RND-DWN RND-UP	229.00 229.50	133L / 196.50	134L / 34.00	C O O C O O C C C O O O O O O O O C O C O O C C C O O O O O O O
135	RND-DWN RND-UP	227.50 228.00	134L / 168.00	135L / 7.50	O C C O O O C C C O O O O O O O C C C O O O C C C O O O O O O O
136	RND-DWN RND-UP	225.50 226.00	135L / 210.00	136L / 52.00	O C O O O O C C C O O O O O O O C C O O O O C C C O O O O O O O
137	RND-DWN RND-UP	224.00 224.50	136L / 188.00	137L / 32.00	C C C C C C O C C O O O O O O O O O O O O O C C C O O O O O O O
138	RND-DWN RND-UP	222.50 223.00	137L / 169.00	138L / 15.00	O O C C C C O C C O O O O O O O C O C C C C O C C O O O O O O O
139	RND-DWN RND-UP	221.00 221.50	138L / 153.00	139L / 1.00	C O O C C C O C C O O O O O O O O C O C C C O C C O O O O O O O
140	RND-DWN RND-UP	219.00 219.50	139L / 209.50	140L / 60.00	C O C O C C O C C O O O O O O O O C C O C C O C C O O O O O O O
141	RND-DWN RND-UP	217.50 218.00	140L / 200.00	141L / 52.50	O C O O C C O C C O O O O O O O C C O O C C O C C O O O O O O O
142	RND-DWN RND-UP	216.00 216.50	141L / 193.50	142L / 48.00	C C C C O C O C C O O O O O O O O O O O C C O C C O O O O O O O
143	RND-DWN RND-UP	214.50 215.00	142L / 190.00	143L / 46.50	O O C C O C O C C O O O O O O O C O C C O C O C C O O O O O O O
144	RND-DWN RND-UP	213.00 213.50	143L / 189.50	144L / 48.00	C O O C O C O C C O O O O O O O O C O C O C O C C O O O O O O O

Continued

TABLE 2-1. SECTOR SWITCH SETTINGS: ST41097J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
145	RND-DWN	211.50		145L / 52.50	O C C O O C O C C O O O O O O
	RND-UP	212.00	144L / 192.00		C C C O O C O C C O O O O O O
146	RND-DWN	210.00		146L / 60.00	C C O O O C O C C O O O O O O
	RND-UP	210.50	145L / 197.50		O O C O O C O C C O O O O O O
147	RND-DWN	208.50		147L / 70.50	O O O O O C O C C O O O O O O
	RND-UP	209.00	146L / 206.00		C O O O O C O C C O O O O O O
148	RND-DWN	207.50		148L / 10.00	O C C C C O O C C O O O O O O
	RND-UP	208.00	147L / 144.00		C C C C C O O C C O O O O O O
149	RND-DWN	206.00		149L / 26.00	C C O C C O O C C O O O O O O
	RND-UP	206.50	148L / 158.00		O O C C C O O C C O O O O O O
150	RND-DWN	204.50		150L / 45.00	O O O C C O O C C O O O O O O
	RND-UP	205.00	149L / 175.00		C O O C C O O C C O O O O O O
151	RND-DWN	203.00		151L / 67.00	C O C O C O O C C O O O O O O
	RND-UP	203.50	150L / 195.00		O C C O C O O C C O O O O O O
152	RND-DWN	202.00		152L / 16.00	C C O O C O O C C O O O O O O
	RND-UP	202.50	151L / 142.50		O O C O C O O C C O O O O O O
153	RND-DWN	200.50		153L / 43.50	O O O O C O O C C O O O O O O
	RND-UP	201.00	152L / 168.00		C O O O C O O C C O O O O O O
154	RND-DWN	199.00		154L / 74.00	C O C C O O O C C O O O O O O
	RND-UP	199.50	153L / 196.50		O C C C O O O C C O O O O O O
155	RND-DWN	198.00		155L / 30.00	C C O C O O O C C O O O O O O
	RND-UP	198.50	154L / 151.00		O O C C O O O C C O O O O O O
156	RND-DWN	196.50		156L / 66.00	O O O C O O O C C O O O O O O
	RND-UP	197.00	155L / 185.00		C O O C O O O C C O O O O O O
157	RND-DWN	195.50		157L / 26.50	O C C O O O O C C O O O O O O
	RND-UP	196.00	156L / 144.00		C C C O O O O C C O O O O O O
158	RND-DWN	194.00		158L / 68.00	C C O O O O O C C O O O O O O
	RND-UP	194.50	157L / 183.50		O O C O O O O C C O O O O O O
159	RND-DWN	193.00		159L / 33.00	C O O O O O O C C O O O O O O
	RND-UP	193.50	158L / 147.00		O C O O O O O C C O O O O O O
160	RND-DWN	192.00			C C C C C C C C O C O O O O O O
	RND-UP	192.00			C C C C C C C C O C O O O O O O
161	RND-DWN	190.50		161L / 49.50	O O C C C C C C O C O O O O O O
	RND-UP	191.00	160L / 160.00		C O C C C C C C O C O O O O O O
162	RND-DWN	189.50		162L / 21.00	O C O C C C C C O C O O O O O O
	RND-UP	190.00	161L / 130.00		C C O C C C C C O C O O O O O O
163	RND-DWN	188.00		163L / 76.00	C C C O C C C C O C O O O O O O
	RND-UP	188.50	162L / 183.00		O O O C C C C C O C O O O O O O
164	RND-DWN	187.00		164L / 52.00	C O C O C C C C O C O O O O O O
	RND-UP	187.50	163L / 157.50		O C C O C C C C O C O O O O O O
165	RND-DWN	186.00		165L / 30.00	C C O O C C C C O C O O O O O O
	RND-UP	186.50	164L / 134.00		O O C O C C C C O C O O O O O O

TABLE 2-2. SECTOR SWITCH SETTINGS: ST41201J

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
4	RND-DWN	8400.00			C C C C C O O C C O O O O O C
	RND-UP	8400.00			C C C C C O O C C O O O O O C
5	RND-DWN	6720.00			C C C C C C C O O O C O C C O
	RND-UP	6720.00			C C C C C C C O O O C O C C O
6	RND-DWN	5600.00			C C C C C C O C C C O C O C O
	RND-UP	5600.00			C C C C C C O C C C O C O C O
7	RND-DWN	4800.00			C C C C C C C O C O C O O C O
	RND-UP	4800.00			C C C C C C C O C O C O O C O
8	RND-DWN	4200.00			C C C C C O O C C O O O O O C O
	RND-UP	4200.00			C C C C C O O C C O O O O O C O
9	RND-DWN	3733.00		9L / 3.00	C O O C O C O O C O C C C O O
	RND-UP	3733.50	8L / 3732.00		O C O C O C O O C O C C C O O
10	RND-DWN	3360.00			C C C C C C O O O O C O C C O O
	RND-UP	3360.00			C C C C C C O O O O C O C C O O
11	RND-DWN	3054.50		11L / 0.50	O O C C C O C C C C C C O C O O
	RND-UP	3055.00	10L / 3050.00		C O C C C O C C C C C C O C O O
12	RND-DWN	2800.00			C C C C C C O C C C O C O C O O
	RND-UP	2800.00			C C C C C C O C C C O C O C O O
13	RND-DWN	2584.50		13L / 1.50	O O O O O C C O O O O C O C O O
	RND-UP	2585.00	12L / 2580.00		C O O O O C C O O O O C O C O O
14	RND-DWN	2400.00			C C C C C C C O C O C O O C O O
	RND-UP	2400.00			C C C C C C C O C O C O O C O O
15	RND-DWN	2240.00			C C C C C C C C O C O O O C O O
	RND-UP	2240.00			C C C C C C C C O C O O O C O O
16	RND-DWN	2100.00			C C C O O C C O O O O O O C O O
	RND-UP	2100.00			C C C O O C C O O O O O O C O O
17	RND-DWN	1976.00		17L / 8.00	C C C C C O C C O C C C C O O O
	RND-UP	1976.50	16L / 1976.00		O O O O O C C C O C C C C O O O
18	RND-DWN	1866.50		18L / 3.00	O O C O C O O C O C C C O O O
	RND-UP	1867.00	17L / 1861.00		C O C O C O O C O C C C O O O
19	RND-DWN	1768.00		19L / 8.00	C C C C C O O C C C O C C O O O
	RND-UP	1768.50	18L / 1767.00		O O O O O C O C C C O C C O O O
20	RND-DWN	1680.00			C C C C C C O O O C O C C O O O
	RND-UP	1680.00			C C C C C C O O O C O C C O O O
21	RND-DWN	1600.00			C C C C C C C C O O O C C O O O
	RND-UP	1600.00			C C C C C C C C O O O C C O O O
22	RND-DWN	1527.00		22L / 6.00	C O C C C O C C C C C O C O O O
	RND-UP	1527.50	21L / 1522.50		O C C C C O C C C C C O C O O O
23	RND-DWN	1460.50		23L / 8.50	O O O C O C C O C C O C O O O
	RND-UP	1461.00	22L / 1458.00		C O O C O C C O C C O C O O O
24	RND-DWN	1400.00			C C C C O C C C O C O C O O O
	RND-UP	1400.00			C C C C O C C C O C O C O O O
25	RND-DWN	1344.00			C C C C C C C O O C O C O O O
	RND-UP	1344.00			C C C C C C C O O C O C O O O
26	RND-DWN	1292.00		26L / 8.00	C C C O C O O O O C O C O O O
	RND-UP	1292.50	25L / 1287.50		O O O C C O O O O C O C O O O
27	RND-DWN	1244.00		27L / 12.00	C C C O C C O C C O O C O O O
	RND-UP	1244.50	26L / 1243.00		O O O C C C O C C O O C O O O

Continued

TABLE 2-2. SECTOR SWITCH SETTINGS: ST41201J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
28	RND-DWN	1200.00			C C C C C O C O C O O C O O O
	RND-UP	1200.00			C C C C C O C O C O O C O O O
29	RND-DWN	1158.50		29L / 3.50	O O C C O O O O C O O C O O O
	RND-UP	1159.00	28L / 1148.00		C O C C O O O O C O O C O O O
30	RND-DWN	1120.00			C C C C C C O C O O O C O O O
	RND-UP	1120.00			C C C C C C O C O O O C O O O
31	RND-DWN	1083.50		31L / 11.50	O C C O C C C O O O O C O O O
	RND-UP	1084.00	30L / 1080.00		C C C O C C C O O O O C O O O
32	RND-DWN	1050.00			C C O O C C O O O O O C O O O
	RND-UP	1050.00			C C O O C C O O O O O C O O O
33	RND-DWN	1018.00		33L / 6.00	C C O O C C C C C C C O O O O
	RND-UP	1018.50	32L / 1008.00		O O C O C C C C C C C O O O O
34	RND-DWN	988.00		34L / 8.00	C C C O C C O C C C C O O O O
	RND-UP	988.50	33L / 979.50		O O O C C C O C C C C O O O O
35	RND-DWN	960.00			C C C C C C C O C C C O O O O
	RND-UP	960.00			C C C C C C C O C C C O O O O
36	RND-DWN	933.00		36L / 12.00	C O O C O O C O C C C O O O O
	RND-UP	933.50	35L / 927.50		O C O C O O C O C C C O O O O
37	RND-DWN	908.00		37L / 4.00	C C C O C O O O C C C O O O O
	RND-UP	908.50	36L / 894.00		O O O C C C O O O C C C O O O O
38	RND-DWN	884.00		38L / 8.00	C C C O O C C C O C C O O O O
	RND-UP	884.50	37L / 873.50		O O O C O C C C O C C O O O O
39	RND-DWN	861.50		39L / 1.50	O C O C C C O C O C C O O O O
	RND-UP	862.00	38L / 844.00		C C O C C C O C O C C O O O O
40	RND-DWN	840.00			C C C C O O O C O C C O O O O
	RND-UP	840.00			C C C C O O O C O C C O O O O
41	RND-DWN	819.50		41L / 0.50	O C C O O C C O O C C O O O O
	RND-UP	820.00	40L / 800.00		C C C O O C C O O C C O O O O
42	RND-DWN	800.00			C C C C C C O O O C C O O O O
	RND-UP	800.00			C C C C C C O O O C C O O O O
43	RND-DWN	781.00		43L / 17.00	C O O C C O O O O C C O O O O
	RND-UP	781.50	42L / 777.00		O C O C C O O O O C C O O O O
44	RND-DWN	763.50		44L / 6.00	O C C O C C C C C O C O O O O
	RND-UP	764.00	43L / 748.00		C C C O C C C C C O C O O O O
45	RND-DWN	746.50		45L / 7.50	O O C O C O C C C O C O O O O
	RND-UP	747.00	44L / 732.00		C O C O C O C C C O C O O O O
46	RND-DWN	730.00		46L / 20.00	C C O O C C O C C O C O O O O
	RND-UP	730.50	45L / 727.50		O O C O C C O C C O C O O O O
47	RND-DWN	714.50		47L / 18.50	O O C O C O O C C O C O O O O
	RND-UP	715.00	46L / 710.00		C O C O C O O C C O C O O O O
48	RND-DWN	700.00			C C C O C C C O C O C O O O O
	RND-UP	700.00			C C C O C C C O C O C O O O O
49	RND-DWN	685.50		49L / 10.50	O C O C C O C O C O C O O O O
	RND-UP	686.00	48L / 672.00		C C O C C O C O C O C O O O O
50	RND-DWN	672.00			C C C C C C C O O C O C O O O
	RND-UP	672.00			C C C C C C C O O C O C O O O
51	RND-DWN	658.50		51L / 16.50	O O C O O C O O C O C O O O O
	RND-UP	659.00	50L / 650.00		C O C O O C O O C O C O O O O

Continued

TABLE 2-2. SECTOR SWITCH SETTINGS: ST41201J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
52	RND-DWN	646.00		52L / 8.00	C C O C O O O O C O C O O O O
	RND-UP	646.50	51L / 628.50		O O C C O O O O C O C O O O O
53	RND-DWN	633.50		53L / 24.50	O C O O C C C C O O C O O O O
	RND-UP	634.00	52L / 632.00		C C O O C C C C O O C O O O O
54	RND-DWN	622.00		54L / 12.00	C C O C C O C C O O C O O O O
	RND-UP	622.50	53L / 607.50		O O C C C O C C O O C O O O O
55	RND-DWN	610.50		55L / 22.50	O O C O O O C C O O C O O O O
	RND-UP	611.00	54L / 606.00		C O C O O O C C O O C O O O O
56	RND-DWN	600.00			C C C C O C O C O O C O O O O
	RND-UP	600.00			C C C C O C O C O O C O O O O
57	RND-DWN	589.00		57L / 27.00	C O O C C O O C O O C O O O O
	RND-UP	589.50	56L / 588.00		O C O C C O O C O O C O O O O
58	RND-DWN	579.00		58L / 18.00	C O C O O O O C O O C O O O O
	RND-UP	579.50	57L / 568.50		O C C O O O O C O O C O O O O
59	RND-DWN	569.00		59L / 29.00	C O O O C C C O O O C O O O O
	RND-UP	569.50	58L / 569.00		O C O O C C C O O O C O O O O
60	RND-DWN	560.00			C C C C C O C O O O C O O O O
	RND-UP	560.00			C C C C C O C O O O C O O O O
61	RND-DWN	550.50		61L / 19.50	O O C C O O C O O O C O O O O
	RND-UP	551.00	60L / 540.00		C O C C O O C O O O C O O O O
62	RND-DWN	541.50		62L / 27.00	O C O C C C O O O O C O O O O
	RND-UP	542.00	61L / 538.00		C C O C C C O O O O C O O O O
63	RND-DWN	533.00		63L / 21.00	C O O C O C O O O O C O O O O
	RND-UP	533.50	62L / 523.00		O C O C O C O O O O C O O O O
64	RND-DWN	525.00			C O O C C O O O O O C O O O O
	RND-UP	525.00			C O O C C O O O O O C O O O O
65	RND-DWN	516.50		65L / 27.50	O O O C O O O O O O C O O O O
	RND-UP	517.00	64L / 512.00		C O O C O O O O O O C O O O O
66	RND-DWN	509.00		66L / 6.00	C O O C C C C C C C O O O O O
	RND-UP	509.50	65L / 482.50		O C O C C C C C C C O O O O O
67	RND-DWN	501.00		67L / 33.00	C O O C O C C C C C O O O O O
	RND-UP	501.50	66L / 501.00		O C O C O C C C C C O O O O O
68	RND-DWN	494.00		68L / 8.00	C C O C C O C C C C O O O O O
	RND-UP	494.50	67L / 468.50		O O C C C O C C C C O O O O O
69	RND-DWN	486.50		69L / 31.50	O O C C O O C C C C O O O O O
	RND-UP	487.00	68L / 484.00		C O C C O O C C C C O O O O O
70	RND-DWN	480.00			C C C C C C O C C C O O O O O
	RND-UP	480.00			C C C C C C O C C C O O O O O
71	RND-DWN	473.00		71L / 17.00	C O O O C C O C C C O O O O O
	RND-UP	473.50	70L / 455.00		O C O O C C O C C C O O O O O
72	RND-DWN	466.50		72L / 12.00	O O C O O C O C C C O O O O O
	RND-UP	467.00	71L / 443.00		C O C O O C O C C C O O O O O
73	RND-DWN	460.00		73L / 20.00	C C C O C O O C C C O O O O O
	RND-UP	460.50	72L / 444.00		O O O C C O O C C C O O O O O
74	RND-DWN	454.00		74L / 4.00	C C O C O O O C C C O O O O O
	RND-UP	454.50	73L / 421.50		O O C C O O O C C C O O O O O
75	RND-DWN	448.00			C C C C C C C O C C O O O O O
	RND-UP	448.00			C C C C C C C O C C O O O O O

Continued

TABLE 2-2. SECTOR SWITCH SETTINGS: ST41201J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
76	RND-DWN	442.00		76L / 8.00	C C O O C C C O C C O O O O O
	RND-UP	442.50	75L / 412.50		O O C O C C C O C C O O O O O
77	RND-DWN	436.00		77L / 28.00	C C C O O C C O C C O O O O O
	RND-UP	436.50	76L / 426.00		O O O C O C C O C C O O O O O
78	RND-DWN	430.50		78L / 21.00	O O C C C C O C O C C O O O O
	RND-UP	431.00	77L / 413.00		C O C C C C O C O C C O O O O
79	RND-DWN	425.00		79L / 25.00	C O O O C O C O C C O O O O O
	RND-UP	425.50	78L / 411.00		O C O O C O C O C C O O O O O
80	RND-DWN	420.00			C C C O O O C O C C O O O O O
	RND-UP	420.00			C C C O O O C O C C O O O O O
81	RND-DWN	414.50		81L / 25.50	O O C C C C O O C C O O O O O
	RND-UP	415.00	80L / 400.00		C O C C C C O O O C C O O O O
82	RND-DWN	409.50		82L / 21.00	O C O O C C O O O C C O O O O
	RND-UP	410.00	81L / 390.00		C C O O C C O O O C C O O O O
83	RND-DWN	404.50		83L / 26.50	O O O C O C O O C C O O O O O
	RND-UP	405.00	82L / 390.00		C O O C O C O O O C C O O O O
84	RND-DWN	400.00			C C C C C C O O O C C O O O O
	RND-UP	400.00			C C C C C C O O O C C O O O O
85	RND-DWN	395.00		85L / 25.00	C O C O C O O O C C O O O O O
	RND-UP	395.50	84L / 378.00		O C C O C O O O C C O O O O O
86	RND-DWN	390.50		86L / 17.00	O O C C O O O O C C O O O O O
	RND-UP	391.00	85L / 365.00		C O C C O O O O C C O O O O O
87	RND-DWN	386.00		87L / 18.00	C C O O O O O O C C O O O O O
	RND-UP	386.50	86L / 361.00		O O C O O O O O C C O O O O O
88	RND-DWN	381.50		88L / 28.00	O C O C C C C C O C O O O O O
	RND-UP	382.00	87L / 366.00		C C O C C C C C O C O O O O O
89	RND-DWN	377.50		89L / 2.50	O C O O C C C C O C O O O O O
	RND-UP	378.00	88L / 336.00		C C O O C C C C O C O O O O O
90	RND-DWN	373.00		90L / 30.00	C O O C O C C C O C O O O O O
	RND-UP	373.50	89L / 358.50		O C O C O C C C O C O O O O O
91	RND-DWN	369.00		91L / 21.00	C O O O O C C C O C O O O O O
	RND-UP	369.50	90L / 345.00		O C O O O C C C O C O O O O O
92	RND-DWN	365.00		92L / 20.00	C O O C C O C C O C O O O O O
	RND-UP	365.50	91L / 339.50		O C O C C O C C O C O O O O O
93	RND-DWN	361.00		93L / 27.00	C O O O C O C C O C O O O O O
	RND-UP	361.50	92L / 342.00		O C O O C O C C O C O O O O O
99	RND-DWN	339.00		99L / 39.00	C O C O O C O C O C O O O O O
	RND-UP	339.50	98L / 329.00		O C C O O C O C O C O O O O O
100	RND-DWN	336.00			C C C C C O O C O C O O O O O
	RND-UP	336.00			C C C C C O O C O C O O O O O
101	RND-DWN	332.50		101L / 17.50	O O O C C O O C O C O O O O O
	RND-UP	333.00	100L / 300.00		C O O C C O O C O C O O O O O
102	RND-DWN	329.00		102L / 42.00	C O O O C O O C O C O O O O O
	RND-UP	329.50	101L / 320.50		O C O O C O O C O C O O O O O
103	RND-DWN	326.00		103L / 22.00	C C O C O O O C O C O O O O O
	RND-UP	326.50	102L / 297.00		O O C C O O O C O C O O O O O
104	RND-DWN	323.00		104L / 8.00	C O C O O O O C O C O O O O O
	RND-UP	323.50	103L / 279.50		O C C O O O O C O C O O O O O

Continued

TABLE 2-2. SECTOR SWITCH SETTINGS: ST41201J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
105	RND-DWN	320.00			C C C C C C C O O C O O O O O
	RND-UP	320.00			C C C C C C C O O C O O O O O
106	RND-DWN	316.50		106L / 51.00	O O O C C C C O O C O O O O O
	RND-UP	317.00	105L / 315.00		C O O C C C C O O C O O O O O
107	RND-DWN	314.00		107L / 2.00	C C O O C C C O O C O O O O O
	RND-UP	314.50	106L / 263.00		O O C O C C C O O C O O O O O
108	RND-DWN	311.00		108L / 12.00	C O C C O C C O O C O O O O O
	RND-UP	311.50	107L / 269.50		O C C C O C C O O C O O O O O
109	RND-DWN	308.00		109L / 28.00	C C C O O C C O O C O O O O O
	RND-UP	308.50	108L / 282.00		O O O C O C C O O C O O O O O
110	RND-DWN	305.00		110L / 50.00	C O O O O C C O O C O O O O O
	RND-UP	305.50	109L / 300.50		O C O O O C C O O C O O O O O
111	RND-DWN	302.50		111L / 22.50	O O C C C O C O O C O O O O O
	RND-UP	303.00	110L / 270.00		C O C C C O C O O C O O O O O
112	RND-DWN	300.00			C C C O C O C O O C O O O O O
	RND-UP	300.00			C C C O C O C O O C O O O O O
113	RND-DWN	297.00		113L / 39.00	C O O O C O C O O C O O O O O
	RND-UP	297.50	112L / 280.00		O C O O C O C O O C O O O O O
114	RND-DWN	294.50		114L / 27.00	O O C C O O C O O C O O O O O
	RND-UP	295.00	113L / 265.00		C O C C O O C O O C O O O O O
115	RND-DWN	292.00		115L / 20.00	C C C O O O C O O C O O O O O
	RND-UP	292.50	114L / 255.00		O O O C O O C O O C O O O O O
116	RND-DWN	289.50		116L / 18.00	O C O O O O C O O C O O O O O
	RND-UP	290.00	115L / 250.00		C C O O O O C O O C O O O O O
117	RND-DWN	287.00		117L / 21.00	C O C C C C O O O C O O O O O
	RND-UP	287.50	116L / 250.00		O C C C C C O O O C O O O O O
118	RND-DWN	284.50		118L / 29.00	O O O C C C O O O C O O O O O
	RND-UP	285.00	117L / 255.00		C O O C C C O O O C O O O O O
119	RND-DWN	282.00		119L / 42.00	C C O O C C O O O C O O O O O
	RND-UP	282.50	118L / 265.00		O O C O C C O O O C O O O O O
120	RND-DWN	280.00			C C C C O C O O O C O O O O O
	RND-UP	280.00			C C C C O C O O O C O O O O O
121	RND-DWN	277.50		121L / 22.50	O C O C O C O O O C O O O O O
	RND-UP	278.00	120L / 240.00		C C O C O C O O O C O O O O O
122	RND-DWN	275.00		122L / 50.00	C O C O O C O O O C O O O O O
	RND-UP	275.50	121L / 264.50		O C C O O C O O O C O O O O O
123	RND-DWN	273.00		123L / 21.00	C O O O O C O O O C O O O O O
	RND-UP	273.50	122L / 233.00		O C O O O C O O O C O O O O O
124	RND-DWN	270.50		124L / 58.00	O O C C C O O O O C O O O O O
	RND-UP	271.00	123L / 267.00		C O C C C O O O O C O O O O O
125	RND-DWN	268.50		125L / 37.50	O O O C C O O O O C O O O O O
	RND-UP	269.00	124L / 244.00		C O O C C O O O O C O O O O O
126	RND-DWN	266.50		126L / 21.00	O O C O C O O O O C O O O O O
	RND-UP	267.00	125L / 225.00		C O C O C O O O O C O O O O O
127	RND-DWN	264.50		127L / 8.50	O O O O C O O O O C O O O O O
	RND-UP	265.00	126L / 210.00		C O O O C O O O O C O O O O O
128	RND-DWN	262.50			O O C C O O O O O C O O O O O
	RND-UP	262.50			O O C C O O O O O C O O O O O

Continued

TABLE 2-2. SECTOR SWITCH SETTINGS: ST41201J (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
129	RND-DWN	260.00		129L / 60.00	C C C O O O O O O C O O O O O
	RND-UP	260.50	128L / 256.00		O O O C O O O O O C O O O O O
130	RND-DWN	258.00		130L / 60.00	C C O O O O O O O C O O O O O
	RND-UP	258.50	129L / 253.50		O O C O O O O O O C O O O O O
131	RND-DWN	256.00		131L / 64.00	C C C C C C C C C O O O O O O
	RND-UP	256.50	130L / 255.00		O O O O O O O O O C O O O O O
132	RND-DWN	254.50		132L / 6.00	O O C C C C C C C O O O O O O
	RND-UP	255.00	131L / 195.00		C O C C C C C C C O O O O O O
133	RND-DWN	252.50		133L / 17.50	O O O C C C C C C O O O O O O
	RND-UP	253.00	132L / 204.00		C O O C C C C C C O O O O O O
134	RND-DWN	250.50		134L / 33.00	O O C O C C C C C O O O O O O
	RND-UP	251.00	133L / 217.00		C O C O C C C C C O O O O O O
135	RND-DWN	248.50		135L / 52.50	O O O O C C C C C O O O O O O
	RND-UP	249.00	134L / 234.00		C O O O C C C C C O O O O O O
136	RND-DWN	247.00		136L / 8.00	C O C C O C C C C O O O O O O
	RND-UP	247.50	135L / 187.50		O C C C O C C C C O O O O O O
137	RND-DWN	245.00		137L / 35.00	C O O C O C C C C O O O O O O
	RND-UP	245.50	136L / 212.00		O C O C O C C C C O O O O O O
138	RND-DWN	243.00		138L / 66.00	C O C O O C C C C O O O O O O
	RND-UP	243.50	137L / 240.50		O C C O O C C C C O O O O O O
139	RND-DWN	241.50		139L / 31.50	O C O O O C C C C O O O O O O
	RND-UP	242.00	138L / 204.00		C C O O O C C C C O O O O O O
140	RND-DWN	240.00			C C C C C O C C C O O O O O O
	RND-UP	240.00			C C C C C O C C C O O O O O O
141	RND-DWN	238.00		141L / 42.00	C C O C C O C C C O O O O O O
	RND-UP	238.50	140L / 210.00		O O C C C O C C C O O O O O O
142	RND-DWN	236.50		142L / 17.00	O O O C C O C C C O O O O O O
	RND-UP	237.00	141L / 183.00		C O O C C O C C C O O O O O O
143	RND-DWN	234.50		143L / 66.50	O O C O C O C C C O O O O O O
	RND-UP	235.00	142L / 230.00		C O C O C O C C C O O O O O O
144	RND-DWN	233.00		144L / 48.00	C O O O C O C C C O O O O O O
	RND-UP	233.50	143L / 209.50		O C O O C O C C C O O O O O O
145	RND-DWN	231.50		145L / 32.50	O C C C O O C C C O O O O O O
	RND-UP	232.00	144L / 192.00		C C C C O O C C C O O O O O O
146	RND-DWN	230.00		146L / 20.00	C C O C O O C C C O O O O O O
	RND-UP	230.50	145L / 177.50		O O C C O O C C C O O O O O O
147	RND-DWN	228.50		147L / 10.50	O O O C O O C C C O O O O O O
	RND-UP	229.00	146L / 166.00		C O O C O O C C C O O O O O O
148	RND-DWN	227.00		148L / 4.00	C O C O O O C C C O O O O O O
	RND-UP	227.50	147L / 157.50		O C C O O O C C C O O O O O O
149	RND-DWN	225.50		149L / 0.50	O C O O O O C C C O O O O O O
	RND-UP	226.00	148L / 152.00		C C O O O O C C C O O O O O O
150	RND-DWN	224.00			C C C C C C O C C O O O O O O
	RND-UP	224.00			C C C C C C O C C O O O O O O
151	RND-DWN	222.50		151L / 2.50	O O C C C C O C C O O O O O O
	RND-UP	223.00	150L / 150.00		C O C C C C O C C O O O O O O
152	RND-DWN	221.00		152L / 8.00	C O O C C C O C C O O O O O O
	RND-UP	221.50	151L / 153.50		O C O C C C O C C O O O O O O

Continued

TABLE 2-2. SECTOR SWITCH SETTINGS: ST4120lJ (Contd)

SECTOR NUMBER	METHOD USED	NORMAL SECTOR	SHORT SECTOR / LENGTH	RUNT SECTOR / LENGTH	SWITCH SETTINGS LSB MSB
153	RND-DWN	219.50		153L / 16.50	O C C O C C O C C O O O O O
	RND-UP	220.00	152L / 160.00		C C C O C C O C C O O O O O
154	RND-DWN	218.00		154L / 28.00	C C O O C C O C C O O O O O
	RND-UP	218.50	153L / 169.50		O O C O C C O C C O O O O O
155	RND-DWN	216.50		155L / 42.50	O O O O C C O C C O O O O O
	RND-UP	217.00	154L / 182.00		C O O O C C O C C O O O O O
156	RND-DWN	215.00		156L / 60.00	C O C C O C O C C O O O O O
	RND-UP	215.50	155L / 197.50		O C C C O C O C C O O O O O
157	RND-DWN	214.00		157L / 2.00	C C O C O C O C C O O O O O
	RND-UP	214.50	156L / 138.00		O O C C O C O C C O O O O O
158	RND-DWN	212.50		158L / 25.00	O O O C O C O C C O O O O O
	RND-UP	213.00	157L / 159.00		C O O C O C O C C O O O O O
159	RND-DWN	211.00		159L / 51.00	C O C O O C O C C O O O O O
	RND-UP	211.50	158L / 183.00		O C C O O C O C C O O O O O
160	RND-DWN	210.00			C C O O O C O C C O O O O O
	RND-UP	210.00			C C O O O C O C C O O O O O
161	RND-DWN	208.50		161L / 31.50	O O O O O C O C C O O O O O
	RND-UP	209.00	160L / 160.00		C O O O O C O C C O O O O O
162	RND-DWN	207.00		162L / 66.00	C O C C C O O C C O O O O O
	RND-UP	207.50	161L / 192.50		O C C C C O O C C O O O O O
163	RND-DWN	206.00		163L / 22.00	C C O C C O O C C O O O O O
	RND-UP	206.50	162L / 147.00		O O C C C O O C C O O O O O
164	RND-DWN	204.50		164L / 62.00	O O O C C O O C C O O O O O
	RND-UP	205.00	163L / 185.00		C O O C C O O C C O O O O O
165	RND-DWN	203.50		165L / 22.50	O C C O C O O C C O O O O O
	RND-UP	204.00	164L / 144.00		C C C O C O O C C O O O O O

USING CALCULATIONS TO SET THE SWITCHES

The information in this topic is intended more for systems designers who are matching the drive's sector length to the nonstandard requirements of certain controllers. This information is organized as follows:

- How to Set Desired Numbers of Sectors
- How to Set Desired Sector Lengths
- How to Calculate Sector Lengths

Two numbers enter into all of the calculations presented here. They are the number of sector clock pulses per disc rotation and the number of bytes per track. Table 2-3 summarizes these numbers.

TABLE 2-3. SECTOR CALCULATION DATA

Characteristics	ST41097J Drives	ST41201J Drives
Bytes per track	30 720	33 600
Sector clock pulses per disc rotation	61 440	67 200
Bytes per sector clock pulse	0.5	0.5

For future reference, you may want to record the switch settings you make. Use the following worksheet:

Number of Sectors: _____

Switch Settings:

2^0 __ 2^1 __ 2^2 __ 2^3 __ 2^4 __

2^5 __ 2^6 __ 2^7 __ 2^8 __ 2^9 __

2^{10} __ 2^{11} __ 2^{12} __ 2^{13} __ 2^{14} __

Runt Sector switch: On __ Off __

Sector Length: _____ bytes

How to Set Desired Numbers of Sectors

This topic describes the process used for calculating sector switch settings for a desired number of sectors per disc rotation. This process is the basis for the sector selection tables (tables 2-1 and 2-2). After a description of the process, there is an example of the calculation. The process makes use of numbers given in table 2-3. Here are the steps required:

1. Calculate the number of selected clock pulses per sector. Use the following formula:

$$\text{Selected Clock Pulses} = \frac{\text{Sector Clock Pulses/Rotation}}{\text{Number of Sectors Desired}} - 1$$

2. If the result in step 1 is not an integer, either round it up or round it down. (The number 1065.7, for example, can be rounded up to 1066 or can be rounded down to 1065.) The effects of using the round-up and round-down methods are described earlier in this section.

3. Express the result of step 2 as a sum of individual sector switch values (see page 2-8). When a switch value appears in the sum, that switch must be placed in the Closed (On) position.

Here is an example of determining the switch settings for selecting 63 sectors for the ST41201J drive, using the round-down method:

1. $$\text{Selected Clock Pulses} = \left(\frac{67\ 200}{63} - 1\right) = (1066.7 - 1)$$
$$= 1065.7$$

2. For the round-down method, this result becomes 1065. (For the round-up method, it would be 1066.)

3. Determine which switches to place in the Closed (On) position as follows:

Selected clock pulses	1065
Clock pulses selected by switch 2^{10}	-1024
(Difference)	41
Clock pulses selected by switch 2^{5}	-32
(Difference)	9
Clock pulses selected by switch 2^{3}	-8
(Difference)	1
Clock pulses selected by switch 2^{0}	-1
(Difference)	0

Thus, placing switches 2^0, 2^3, 2^5, and 2^{10} in the Closed (On) position selects 63 sectors. Since a remainder existed in the formula and was rounded down, an additional sector pulse will appear just before index (unless the Runt Sector switch is set to On).

If the result (1065.7) had been rounded up, switches 2^1, 2^3, 2^5, and 2^{10} would have been placed in the Closed (On) position to select 63 sectors. Since a remainder existed in the formula and was rounded up, the last sector (logical 62) will be shorter than the earlier sectors.

Refer to How to Calculate Sector Lengths (later in this section) for information on finding the number of bytes in the normal sectors and in the last sector. If the last sector is too short to be compatible with controller requirements, consider the option of runt suppression.

How to Set Desired Sector Lengths

This topic describes the process used for calculating sector switch settings for a desired sector length. It also provides an example of the calculation.

With this method, there is no attempt to divide the disc rotation into nearly equal segments. Instead, the method starts with a known sector length (data field plus overhead, expressed in bytes). The process makes use of numbers given in table 2-3. Here are the steps required:

1. Calculate the number of selected clock pulses per sector. Use the following formula:

$$\text{Selected Clock Pulses} = \frac{\text{Sector Length in Bytes}}{\text{Bytes per Sector Clock Pulse}} - 1$$

2. Express the result of step 1 as a sum of individual sector switch values (see page 2-8). When a switch value appears in the sum, that switch must be placed in the Closed (On) position.

Here is an example of determining the switch settings for selecting 572-byte sectors (512-byte data field plus 60 bytes of overhead) for an ST41201J drive:

1. $\text{Selected Clock Pulses} = (\frac{572}{0.5} - 1) = (1144 - 1) = 1143$

2. Determine which switches to place in the Closed (On) position as follows:

Selected clock pulses	1143
Clock pulses selected by switch 2^{10}	-1024
(Difference)	119
Clock pulses selected by switch 2^{6}	-64
(Difference)	55
Clock pulses selected by switch 2^{5}	-32
(Difference)	23
Clock pulses selected by switch 2^{4}	-16
(Difference)	7
Clock pulses selected by switch 2^{2}	-4
(Difference)	3
Clock pulses selected by switch 2^{1}	-2
(Difference)	1
Clock pulses selected by switch 2^{0}	-1
(Difference)	0

Thus, placing switches 2^{0}, 2^{1}, 2^{2}, 2^{4}, 2^{5}, 2^{6}, and 2^{10} in the Closed (On) position selects the sectors with the required length.

Refer to the next topic for information on finding the number of bytes in the normal sectors and in the last sector. If the last sector is too short to be compatible with controller requirements, consider the option of runt suppression.

How to Calculate Sector Lengths

This method for calculating sector lengths uses the actual sector switch settings as a starting point. It works for any combination of switch settings regardless of how they were derived. This topic describes the process involved and provides an example of how to do the calculation.

1. Examine the sector switches and note which ones are in the Closed (On) position.

2. For each sector switch noted in step 1, write down its decimal value given on page 2-8.

3. Add the numbers accumulated in step 2. If you used the calculation formula in either of the preceding topics to obtain the sector switch settings, take note. The sum in this step is the same number derived in step 2 of those topics.

4. Add 1 to the result in step 3 to obtain the length of a sector expressed in sector clock pulses.

5. Multiply the result in step 4 by the number of bytes per sector clock pulse (given in table 2-3) to obtain the number of bytes per sector.

Here is an example of determining the sector length for an ST41201J drive:

1. You observe that the following switches are in the Closed (On) position: 2^0, 2^3, 2^5, and 2^{10}.

2. The Closed sector switches have the following values:

2^0	1
2^3	8
2^5	32
2^{10}	1024

3. These numbers total 1 + 8 + 32 + 1024 = 1065.

4. By adding 1, you get 1065 + 1 = 1066.

5. The drive has 0.5 bytes per sector clock pulse. You get the sector length by multiplying 1066 by 0.5; it is 533 bytes.

You may be wondering at this point how long the last sector is. You have found that each of the normal sectors is 533 bytes long. Refer to table 2-3 to find the number of bytes per track (33 600 for this drive).

To find the number of full-length sectors, divide 33 600 by 533. It is 63 with a remainder of 21. This calculation implies that there are 63 normal sectors, each 533 bytes long (logical sectors 0 through 62), followed by a runt sector of 21 bytes (logical sector 63).

A check of the sector switch settings (table 2-2 for this drive) indicates that the round-down method for 63 sectors was applied to obtain the switch settings.

With the Runt Sector switch On, runt sector pulses are suppressed. In this case, logical sector 62 contains 533 + 21 = 554 bytes.

PROGRAMMING THE SWEEP CYCLE FUNCTION

The sweep cycle is a feature that periodically moves the heads to different locations on the discs during intervals when the drive is idle. The following are highlights of the sweep cycle function:

- Using the sweep cycle enhances drive reliability. We encourage you either to enable the drive sweep cycle or to use a sweep cycle driven at the system or subsystem level. Consult with an analyst in making this choice.

- There are several sweep cycle options available at the drive level. To make sure that the selected option is compatible with system operation, check the controller user's manual.

- The sweep routine consumes approximately 11 seconds of a 13-hour period. Thus, the drive is available to the system more than 99.98% of the time.

- You may disable the sweep cycle (described below) without affecting the specified Mean Time Between Failures (MTBF) or warranty agreements.

Status codes associated with the sweep cycle are discussed in section 3 of this manual.

The drive is preset during manufacturing with a set of sweep cycle options selected. Two DIP switches on the servo board control the selection, as shown earlier in figure 2-5.

The two sweep cycle switches are identified as Sweep Cycle Enable and Enable Sweep Only on Seeks. The following paragraphs discuss the functions controlled by each switch and tell different ways to position the switches:

Sweep Cycle Enable -- enables or disables the sweep cycle function. The switch can be positioned as follows:

- Open (Off) position -- disables the sweep cycle function. The other switch then has no effect.

- Closed (On) position -- enables the sweep cycle function.

Enable Sweep Only on Seeks -- enables or disables the option to sweep only on seeks. When enabled, sweep movements can occur only in conjunction with seeks required by the controller. Each time the drive performs a sweep cycle, it starts a 12-minute timeout. When the timeout has elapsed, the drive performs another sweep cycle only when it receives a Seek command (Tag 1). When combining a sweep cycle with a seek, the drive performs the sweep cycle first and then executes the Seek command. The switch can be positioned as follows:

- Open (Off) position -- disables the option to sweep only on seeks (sweep cycles can be initiated within the drive).
- Closed (On) position -- enables the option to sweep only on seeks (each sweep segment is part of a controller-driven seek).

If a sweep segment was initiated by a Seek command, the drive performs the sweep function and then moves the heads to the cylinder requested by the controller.

If a sweep segment is initiated within the drive, the drive performs the seek and returns to the original cylinder (where it was before the seek occurred. When it returns depends on drive activity. If the drive had not been selected during the 12 minutes prior to a sweep, the heads stay on a cylinder accessed during the sweep segment. Later, when the drive is reselected, the heads return to the original cylinder.

Figure 2-8 shows a profile (not to scale) of typical sweep activity for the case where sweeps can be initiated within the drive (Enable Sweep Only on Seeks disabled).

Section 3
Interface Functions

INTERFACE FUNCTIONS 3

INTRODUCTION

This section describes the SMD interface and its associated hardware. The section is divided into the following areas:

- I/O Cables -- Describes the signal lines on the interface.
- Interface Signal Processing -- Shows how the interface transfers commands, status, and data.
- Unit Selection -- Describes drive selection either by one controller or by one of two controllers.

All communications between drive and controller must pass through the interface. This communication includes all commands, status, control signals, and read/write data transfers.

The interface consists of the I/O cables and the logic required to process the signals sent between drive and controller. A switch setting selects the version of SMD interface used:

- SMD-0 -- Standard SMD interface uses Tags 1 through 3.
- SMD-E -- Enhanced SMD interface uses Tags 1 through 6.

More information about the SMD-0/SMD-E selection and about the other options for extended cylinder addressing appears later in this section under I/O Signal Processing. For additional information about the SMD-E interface, refer to the Seagate SMD-E Interface specification (document 64712402).

I/O CABLES

The drive has two I/O cables per channel, consisting of a control (A) cable and a data (B) cable. These cables contain all the lines going between the drive and controller.

The A cable carries commands and control information to the drive and status information to the controller. The B cable carries read/write data, clock, and status information between drive and controller. Figure 3-1 shows all lines (except ground wires) in the A and B cables. The function of each of these lines is explained in tables 3-1 and 3-2.

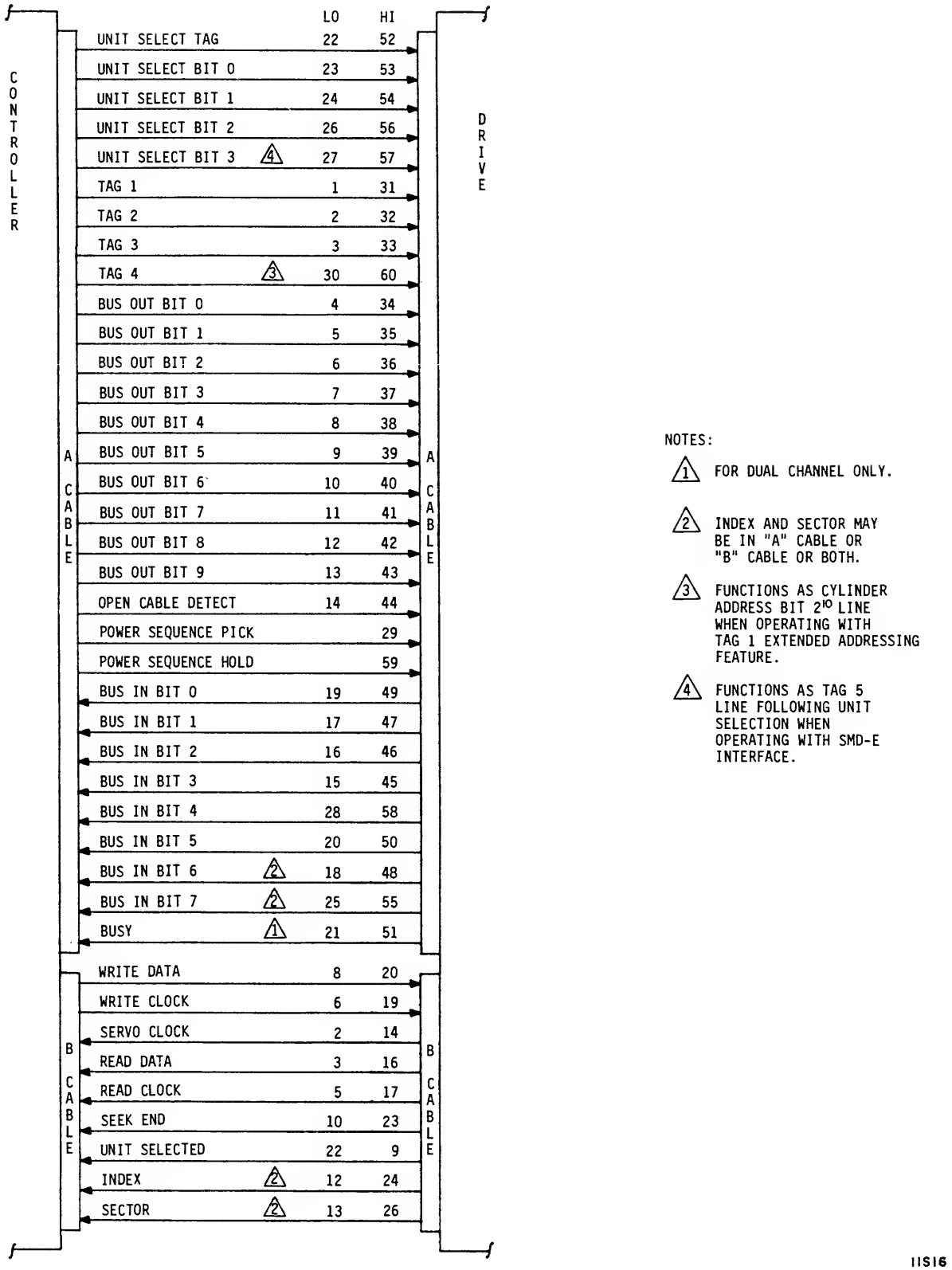

Figure 3-1. Interface Lines

TABLE 3-1. CONTROLLER TO DRIVE INTERFACE LINES

Line	Function
Bus Out Bits 0-9	These ten lines carry data to the drive. The meaning of the data is a function of the active tag line.
Open Cable Detect	A voltage is supplied by the controller to override the bias voltage at the drive receivers. If the A cable is disconnected or if controller power is lost, unit selection and controller commands are inhibited.
Sequence Pick or Sequence Hold	A ground from the controller on either of these lines starts the power on cycle on all drives in the string, provided that the Remote/Local switch is set in the Remote position. These lines have no effect in the Local mode.
Tags 1-3, Tag 4/Cyl. Addr. Bit 2^{10}	These lines carry information that is decoded by the drive tag/bus decode logic and used in conjunction with Bus Out lines 0 through 9 to produce desired functions (refer to table 3-3). When operating with the Tag 1 Extended Addressing Feature, the Tag 4 line functions as the Cylinder Address Bit 2^{10} line.
Unit Select Bits 0, 1, 2, and 3/ Tag 5	A binary code is placed on these four lines to select a drive. The binary code must match the logical address assigned to the drive. Drives can be numbered 0 through 15. Bit 3 serves a dual purpose as follows: 1. When gated with Unit Select Tag, this line must match the high order bit of the unit number for a unit selection to occur. 2. Following unit selection on drives configured with the SMD-E interface, this bit functions as the Tag 5 line.

Continued

TABLE 3-1. CONTROLLER TO DRIVE INTERFACE LINES (Contd)

Line	Function
Unit Select Tag	This signal gates Unit Select lines into a compare circuit. The unit is selected 600 ns (maximum) after Unit Select Tag becomes active. The drive will not process commands until selected. Drive status is returned on Bus In lines while unit is selected (refer to Tag 1 Bus In description). Deselection occurs 600 nanoseconds (maximum) after Unit Select Tag drops. In dual-channel units, the Unit Select Tag also causes the drive to be reserved to the issuing channel provided selection occurs. The reserve condition can be cancelled by a Release command, a reserve timeout, or by a Priority Select (i.e Unit Select Tag accompanied by proper logical address and Bus Out Bit 9 active). The drive is unconditionally selected and reserved by the channel issuing a Priority Select command provided that the issuing channel has not been disabled.
Write Clock	This clock is the Servo Clock retransmitted to the drive during a write operation. Write Clock must be synchronized to the NRZ data and must be transmitted 250 ns prior to Write Gate.
Write Data	This line transmits NRZ data from the controller to the drive for recording on the disc surface.

TABLE 3-2. DRIVE TO CONTROLLER INTERFACE LINES

Line	Function
Bus In Bits 0-7	These eight lines carry status, drive identity, and current sector location information to the controller.
Busy	Used only for dual-channel operation of drives, this signal is generated when a controller attempts to select a drive that has already been selected or reserved by the other controller. This signal is sent to the controller attempting the selection.
Index Mark	This signal is derived from the servo tracks to indicate the start of the track. It occurs once per rotation of the disc, and its leading edge is the leading edge of sector zero. Note: This signal (on the B cable) may be disabled by switch selections on the I/O boards.
Read Clock	This clock is derived from, and is synchronous with, the detected data. Read Clock defines the beginning of a data cell.
Read Data	This line transmits data recovered from the disc. The data is transmitted in NRZ form to the controller.
Sector Mark	This signal is derived from the servo tracks. The number of sector marks that occur for each rotation of the disc is selected by switches on the servo board (described in section 2). Note: This signal (on the B cable) may be disabled by switch selections on the I/O boards.

Continued

TABLE 3-2. DRIVE TO CONTROLLER INTERFACE LINES (Contd)

Line	Function
Seek End	This signal indicates either on cylinder status or seek error status resulting from a seek operation that has terminated. When SMD-E interface drives respond to a Tag 5 execute diagnostic test command, Seek End indicates that test execution is complete. In dual-channel configurations, the Seek End signal to the unreserved channel is active continuously except when the unreserved channel attempts to select the drive. If there was an attempt, it causes Seek End to the unreserved channel to drop for 30 microseconds when the reserved channel drops its select and reserve condition.
Servo Clock	Servo Clock is a phase-locked signal generated from the servo track. It is continuously transmitted. The Servo Clock frequency is 22.1 MHz on the ST41097J drive or 24.2 MHz on the ST41201J drive.
Unit Selected	This signal indicates the drive has accepted a Unit Select request. The line must be active before the drive will respond to any command from the controller.

I/O SIGNAL PROCESSING

I/O signals from the controller initiate and control all drive operations except spindle power-on. The I/O signals are received in the drive I/O boards where they are routed to the appropriate logic in the drive. In turn, the drive sends information back to the controller via drivers on the I/O boards.

The drive can be configured to operate with either a standard SMD (SMD-0) interface or an enhanced SMD (SMD-E) interface. A switch setting selects the version of SMD interface used:

- SMD-0 -- Standard SMD interface uses Tags 1 through 3.
- SMD-E -- Enhanced SMD interface uses Tags 1 through 6.

In addition, two types of extended addressing are available with either interface type: Tag 1 extended addressing, and Tag 2 extended addressing. Because of signal line contention, SMD-E units configured with Tag 1 extended addressing cannot use Tags 4 and 6.

A unit not configured with either extended addressing feature can address up to 1024 cylinders (0-1023). Extended addressing allows the drive to address additional cylinders as follows:

- Tag 1 extended addressing allows the drive to address 2048 cylinders (0-2047).
- Tag 2 extended addressing allows the drive to address all 2101 cylinders (0-2100).

When the drive is selected, the tag receivers are enabled. With the Unit Select Tag active, commands are generated based upon the tag code as defined by the Bus Out lines. Table 3-3 provides a summary of the tag and bus decoding. Table 3-4 expands on this summary by defining Bus Out and Bus In for each tag.

TABLE 3-3. SUMMARY OF TAG/BUS DECODING

Bus Out Bits	Unit Select Tag	Tag 1	Tag 2	Tag 3
		Low Cylinder Select	Head and High Cylinder Select	Control Select
0		2^0	2^0	Write Gate
1		2^1	2^1	Read Gate
2		2^2	2^2	Servo Offset Plus
3		2^3	2^3	Servo Offset Minus
4		2^4	2^4	Fault Clear
5		2^5		Address Mark Enable
6		2^6		Return to Zero
7		2^7	2^{10} *	Data Strobe Early
8		2^8	2^{11} *	Data Strobe Late
9	Priority Select	2^9		Release
10		2^{10} *		

Bus In Bits	Unit Select Tag	Tag 1	Tag 2	Tag 3
	Drive Status			
0	← - - - - - - - - - - - - - - - Unit Ready - - - - - - - - - - - - - - - →			
1	← - - - - - - - - - - - - - - - On Cylinder - - - - - - - - - - - - - - - →			
2	← - - - - - - - - - - - - - - - Seek Error - - - - - - - - - - - - - - - →			
3	← - - - - - - - - - - - - - - - Fault - - - - - - - - - - - - - - - →			
4	← - - - - - - - - - - - - - - - Write Protect - - - - - - - - - - - - - - - →			
5	← - - - - - - - - - - - - - - - Address Mark - - - - - - - - - - - - - - - →			
6	← - - - - - - - - - - - - - - - Index Mark - - - - - - - - - - - - - - - →			
7	← - - - - - - - - - - - - - - - Sector Mark - - - - - - - - - - - - - - - →			

Bus Out Bits	Tag 4*	Tag 5				Tag 6*
	Current Sector	Fault Status Request	Operating Status Request	Failure Status Request	Execute Diagnostic Test Command	Device Type
0	0	0	1	0	1	0
1	0	0	0	1	1	0
2-9	0	0	0	0	0	0
10	X	0	0	0	0	X

Bus In Bits	Tag 4*	Tag 5				Tag 6*
	Current Sector Count	Extended Fault Status	Operating Status	Failure Status**	Diagnostic Execute Status	Device Type Status
0	2^0	Read • Write	↑	↑	0	↑
1	2^1	Read + Write • Not On Cylinder	See		0	Customer
2	2^2	First Seek		See	0	Defined
3	2^3	Write	Table		0	
4	2^4	Write • Write Protected		Note**	0	By
5	2^5	Head Select	3-4	Below	0	Switch
6	2^6	Voltage	↓		0	Settings
7	2^7	Valid Status Available	Valid Status Available	↓	Test is Executing	↓

* Choice of Tag 1 or Tag 2 Extended Addressing affects position of Cylinder Address Bit 2^{10} in this table. Tags 4 and 6 are not available if Tag 1 Extended Addressing is chosen.

** Failure Status is not available.

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS

I/O Signals	Function
TAG 1 -- CYLINDER SELECT/LOW CYLINDER SELECT This tag initiates a seek operation. On units not configured with the Tag 1 extended addressing feature, this tag line gates ten address lines to the drive Cylinder Address register. In addition, on units with the Tag 1 extended addressing feature, this tag gates Bit 2^{10} of the cylinder address to the drive Cylinder Address register on A cable lines 30 and 60 (Tag 4). Tag 1 extended addressing allows drives to address cylinders 0 through 2047. Drive status information is returned on the Bus In lines. On units configured with the Tag 2 extended addressing feature, Tag 2 must precede Tag 1 to ensure that the higher order cylinder address bits are gated into the Cylinder Address register before the seek is initiated. Tag 2 extended addressing allows drives to address all cylinders (0 through 2100). With Tag 2 extended addressing, commanding a drive to seek beyond its maximum legal cylinder address will cause a seek error.	
Bus Out Bits	Defined as follows:
BOB0	Cylinder Address 2^0
BOB1	Cylinder Address 2^1
BOB2	Cylinder Address 2^2
BOB3	Cylinder Address 2^3
BOB4	Cylinder Address 2^4
BOB5	Cylinder Address 2^5
BOB6	Cylinder Address 2^6
BOB7	Cylinder Address 2^7
BOB8	Cylinder Address 2^8
BOB9	Cylinder Address 2^9
BOB10	Cylinder Address 2^{10} (Used only with Tag 1 extended addressing)
Bus In Bits	Defined as follows:
BIB0	Unit Ready -- Unit Ready indicates that the drive is up to speed, that the first seek was successful, and that no fault condition exists.

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
BIB1	On Cylinder -- This signal indicates that the servo head is positioned at a track. This line goes inactive if the positioner drifts off cylinder.
BIB2	Seek Error -- this signal indicates one of the following conditions: • The drive took too long to complete a seek. • The positioner has moved outside the recording field. • The drive was commanded to seek beyond cylinder 2100, its maximum legal cylinder (possible with Tag 2 extended addressing). The seek error can be cleared by an RTZ command.
BIB3	Fault -- When this line is active, it indicates that one or more of the following faults exist: • Read and Write Fault • Write or Read Attempted While Off Cylinder • First Seek Fault • Write Fault • Write and Write Protected Fault • Head Select Fault • Voltage Fault

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
BIB4	Write Protect -- This signal indicates that the drive write circuits are disabled. Attempting to write while the write protect mode is active results in a fault condition. The write protect mode is enabled by any of the following: • a switch on the servo board • a fault condition • a loss of motor speed.
BIB5	Address Mark -- When an address mark has been found during an address mark search operation, this line goes high (refer to Tag 3 description).
BIB6	Index Mark -- This signal is derived from the servo tracks. It occurs once per rotation of the disc, and its leading edge is the leading edge of sector zero. Note: This signal (on the A cable) may be disabled by switch selections on the I/O boards.
BIB7	Sector Mark -- This signal is derived from the servo tracks. The number of sector marks that occur for each rotation of the disc is selected by switches on the servo board (described in section 2). Note: This signal (on the A cable) may be disabled by switch selections on the I/O boards.

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
TAG 2 -- HEAD SELECT/HIGH CYLINDER SELECT This tag line gates the data on the bus out lines to the drive Head Address register and also provides the high order Cylinder Address Bits 2^{10} and 2^{11} on units configured with the Tag 2 extended addressing feature. Tag 2 extended addressing allows drives to address all legal cylinders (including those greater than 1023). Commanding a drive to seek beyond its maximum legal cylinder address will cause a seek error. Drive status information is returned on the Bus In lines (refer to Tag 1 Bus In description). On units configured with the Tag 2 extended addressing feature, Tag 2 must precede Tag 1 to ensure that the higher order cylinder address bits are gated into the Cylinder Address register before the seek is initiated.	
Bus Out Bits	Defined as follows:
BOB0	Head Address 2^0
BOB1	Head Address 2^1
BOB2	Head Address 2^2
BOB3	Head Address 2^3
BOB4	Head Address 2^4
BOB5-6	Not used
BOB7	Cylinder Address 2^{10}
BOB8	Cylinder Address 2^{11}
BOB9	Not used
Bus In Bits	Refer to description of Bus In Bits under Tag 1.
TAG 3 -- CONTROL SELECT This tag line gates the data on the bus lines to the logic circuits of the drive for commanding various operations. The operation performed is dependent upon which of the Bus Out lines is active. Drive status information is returned on the Bus In lines (refer to Tag 1 Bus In description).	

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
Bus Out Bit	Defined as follows:
BOB0	Write Gate -- Enables write driver. Not accepted if there is a seek error or fault status.
BOB1	Read Gate -- Enables read circuitry. Leading edge triggers the read chain circuit to synchronize on an all zeros pattern. Not accepted if there is a seek error or fault status.
BOB2	Servo Offset Plus -- Offsets the positioner from the on cylinder position by shifting it slightly toward the spindle. Disables On Cylinder for 2.75 milliseconds.
BOB3	Servo Offset Minus -- Offsets the positioner from the on cylinder position by shifting it slightly away from the spindle. Disables On Cylinder for 2.75 milliseconds.
BOB4	Fault Clear -- A pulse sent to the drive that clears the Fault latch provided that the fault condition no longer exists.
BOB5	Address Mark Enable -- When this signal occurs with a Write Gate, an address mark is written. When this signal occurs with a Read Gate, an address mark search is initiated.
BOB6	RTZ -- A pulse sent to the drive to move the positioner to track zero. It also resets the Head Address register, Cylinder Address register, and Seek Error latch.

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
BOB7	Data Strobe Early -- Enables the read comparator to strobe the data at a time earlier than nominal.
BOB8	Data Strobe Late -- Enables the read comparator to strobe the data at a time later than nominal.
BOB9	Release -- Used for dual-channel operation only, it clears channel reserved and channel priority select status. (Refer to Unit Selection discussion.)
Bus In Bits	Refer to description of Bus In Bits under Tag 1.

TAG 4 -- CURRENT SECTOR (SMD-E ONLY)

This tag allows the current sector address to be transmitted to the controller on the Bus In lines. A sector address can be any number from 0 to 255. Bus Out Bits 0 through 9 are undefined. Note: This tag is not usable when the unit is configured with Tag 1 Extended Addressing.

Bus In Bits	Defined as follows:
BIB0	Sector Address 2^0
BIB1	Sector Address 2^1
BIB2	Sector Address 2^2
BIB3	Sector Address 2^3
BIB4	Sector Address 2^4
BIB5	Sector Address 2^5
BIB6	Sector Address 2^6
BIB7	Sector Address 2^7

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
TAG 5 -- EXTENDED STATUS (SMD-E ONLY) This tag allows extended fault status and operating status to be transmitted to the controller on Bus In lines or allows the execute diagnostic test command to be issued. Failure status is not available. Except for the execute diagnostic test commands, this tag can be executed at any time. Execute diagnostic test command can be requested whenever the drive has completed the load sequence. The type of status transmitted on Bus In is determined by the state of Bus Out Bits 0 and 1. Note: Bus Out Bits 2 through 9 should be set to zero.	
Bus Out Bits 0-1 00	Extended Fault Status -- When Bus Out Bits 0 and 1 are set to zero, current fault status is transmitted on Bus In as follows:
Bus In Bits	
BIB0	Read and Write Fault
BIB1	Read or Write and Off Cylinder Fault
BIB2	First Seek Fault
BIB3	Write Fault
BIB4	Write and Write Protected Fault
BIB5	Head Select Fault
BIB6	Voltage Fault
BIB7	Valid Status Available

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
Bus Out Bits 0-1 10	Operating Status -- When Bus Out Bit 0 is a "1" and Bus Out Bit 1 is a "0", then Bus In Bits 0 through 6 reflect drive operating status codes. Bus In Bit 7 indicates that valid status is available. The codes are as follows: Normal Operation Codes (Bit 6 is a zero) 80 Ready 82 Stopping Motor 83 Motor Stopped 84 Load/Cal in Progress 85 Power Sequence in Progress 87 Starting Motor 88 Motor Up to Speed 8A Sweep Segment in Progress 8B Heads Left on Last Cylinder of Sweep 8C Ready But Not On Cylinder 90 Ready & Spindle in Sync 91 Servo MPU Communication Test Passed 94 Load/Cal in Progress & Spindle in Sync 98 Motor Up to Speed & Spindle in Sync 9A Sweep Segment in Progress & Spindle in Sync 9B Heads Left on Last Cylinder of Sweep & Spindle in Sync 9C Ready & Spindle in Sync But Not On Cylinder

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
Bus Out Bits 0-1 10	Operating Status (Contd) Drive Error Codes (Bit 6 is a one) C6 Seek Timeout CA Move Failed Due to Demodulator Check CB Off-Track Seek Error CC Seek Error Due to Actuator Locked or No Demodulator Active CD Illegal Cylinder Address CE Seek Error Due to Fault CF Seek Error on Settle In D0 Low Vcc Glitch Recovery D2 Motor Stopped -- Braking Loop Failed D3 First Seek Fault -- Motor Below Speed D4 First Seek Fault -- Data Ready Pulse 1 Not Found D5 First Seek Fault -- Data Ready Pulse 2 Not Found D6 First Seek Fault -- Demodulator Active Not Found D7 First Seek Fault -- Index Not Found D8 Speed Loss D9 Speed Loss Restart DC Locked Rotor E0 Servo MPU Dead E1 Servo MPU Communication Check Failed E5 First Seek Failed for the Second Time E6 Scan Failed -- Recovery in Progress E7 Scan Failed for the Second Time -- Abort the Scan E8 Seek Failure During Sweep

Continued

TABLE 3-4. TAG/BUS COMMAND DECODE FUNCTIONS (Contd)

I/O Signals	Function
Bus Out Bits 0-1 01	Failure Status -- When Bus Out Bit 1 is a "1" and Bus Out Bit 0 is a "0", then the controller requests failure status. However, this drive does not report failure status.
Bus In Bits 7-0	Undefined
Bus Out Bits 0-1 11	Execute Diagnostic Test Command -- When Bus Out Bits 0 and 1 are "1", then Bus In Bits 0 through 6 are undefined and Bit 7 indicates that a diagnostic test is executing. The following diagnostic tests are performed: • Return to Zero (RTZ) Seek • Single-Track Seek • Servo Recalibrate • Maximum-Length Seek
TAG 6 -- DEVICE TYPE (SMD-E ONLY) Tag 6 (activating Tags 4 and 5 simultaneously) causes customer selected device type status to be returned on Bus In lines 0 through 7. Note: This tag is not usable when the unit is configured with Tag 1 Extended Addressing.	

UNIT SELECTION

The drive must be selected before it will respond to any commands from the controller. This is the case because the tag and bus bit receivers, as well as certain drivers, are not enabled until the drive is selected.

In both single- and dual-channel units, the select sequence is initiated by a Unit Select Tag signal from the controller. However, the sequence performed is different depending on whether a single or dual channel is being considered. Since only one controller can communicate with the drive at a time, dual-channel logic must solve the problem of priority when more than one controller wants to select the drive at the same time. The following paragraphs describe both single- and dual-channel selection.

SINGLE-CHANNEL UNIT SELECTION

The single-channel unit select sequence starts when the controller sends the Unit Select Tag accompanied by a logical address on the four unit select lines.

When the drive recognizes the Unit Select Tag, it compares its own logical address to the address sent by the controller. The drive's logical address is determined by switch settings on the servo board. This address can be any number from 0 to 15.

If the address sent by the controller is the same as that of the drive and if the Open Cable Detect signal is inactive (indicating the A cable is connected, controller has power, and the channel is not disabled), the drive enables the Unit Selected signal to the controller. The drive also enables the receivers and drivers to the controller. The drive is now ready to respond to further commands from the controller.

DUAL-CHANNEL UNIT SELECTION

Dual-channel drives are connected to, and can be selected by, either of two controllers. However, because the drive is capable of responding to only one controller at a time, the controllers must compete for use of the drive. For this reason, there are functions associated with dual-channel selection that are not necessary when selecting single-channel units.

The functions controlling dual-channel selection are as follows:

- Select -- Logically connects the drive to the controller, thus enabling it to respond to commands from the selecting controller.
- Reserve -- Reserves the drive so it can be selected at any time by the reserving controller, but prevents it from being selected by the other controller.
- Release -- Releases drive from reserved condition.
- Priority Select -- Allows controller to force select the drive by disabling the interface to the controller having the drive selected or reserved.
- Disable -- Allows disabling either channel interface during maintenance.

The following discussions describe each of these functions. Because these functions are basically the same regardless of which channel is involved, they are described only as they relate to channel I.

Select and Reserve Function

The drive is both selected and reserved by a Unit Select Tag sequence accompanied by a logical address. However, the drive can be successfully selected and reserved only if none of the following conditions exist:

- Drive is already selected and reserved by other controller.
- Drive is not selected but is reserved by other controller.
- Channel to drive attempting selection has been disabled by either a priority select function or a channel disable switch.

The following paragraphs describe how the drive is initially selected and also how it responds to a Unit Select Tag when it is selected, reserved, or disabled.

Assuming the drive is available (not selected, reserved, or disabled) and it receives a Unit Select Tag and logical address from the controller on channel I, it compares the address received with that indicated by its logical address switches. The logic used to compare the addresses is identical to that used in the single-channel units.

If the two addresses are the same, the drive sends Unit Selected to the channel 1 controller. The drive enables the receivers and drivers to the channel I controller and, after a delay, is reserved to channel I.

Providing channel II does not issue a priority select command (see Priority Select Function discussion), the drive remains selected to channel I until the controller on channel I drops its Unit Select Tag. At this time, the drive disables the drivers and receivers for that channel. It also disables the Unit Selected signal thus informing the controller that the drive will no longer respond to commands. However, the drive remains reserved to channel I (allowing channel I to reselect while preventing channel II from selecting) until the reserve condition is also cleared. It is cleared by either a release or priority select function (refer to these discussions).

If channel I attempts to select and reserve the drive while it is selected and reserved by channel II, the attempt is unsuccessful. The drive still sends the Channel I Unit Selected signal to the controller, but, in this case, it is accompanied by the Channel I Busy signal. The Busy signal indicates that the drive is selected or reserved by channel II.

The unsuccessful attempt to select and reserve the drive is latched. When the drive is no longer selected or reserved by channel II, the drive logic causes Seek End to the channel I controller to go low for 30 microseconds. This informs the channel 1 controller that the drive is no longer selected or reserved.

If the channel I controller tries to select the drive while channel I is disabled (either by a priority select or maintenance disable function), the attempt is unsuccessful and no response is sent back to the channel I controller.

Release Function

The release function will release the drive from either a reserved or priority selected condition. There are two types of release functions:

- Reserve Timeout
- Release Command

The reserve timeout releases the drive from the reserved condition 500 ms after the drive is deselected, provided that the AR/RT switch is in the RT (reserve timeout) position. Following the timeout, the drive is available to the other channel. However, if this switch is in AR (absolute reserve) position, the timeout has no effect, and the drive remains reserved.

A Release command will release the drive from both the reserved and priority selected conditions. This command is initiated by the reserving or priority selecting controller when it issues a Tag 3 (Control Select) with Bus Out Bit 9 active. This allows the other controller to select the drive once the issuing controller drops its Unit Select Tag.

Priority Select Function

If the drive is selected and reserved, the other controller can force selection by issuing a Priority Select command (Unit Select Tag accompanied by drive logical address and Bus Out Bit 9). This command will disable the channel to the controller presently using the drive and also select and reserve the drive to the controller issuing the Priority Select command.

For example if channel I has the drive and channel II wants to select, channel II issues a Priority Select command. In this case, the command clears the selected and reserved conditions for channel I. It also selects and reserves the drive for channel II. Channel I is then disabled until channel II releases the drive.

Disable Function

It is also possible to disable either channel by setting both Disable switches for that channel to the disable position.

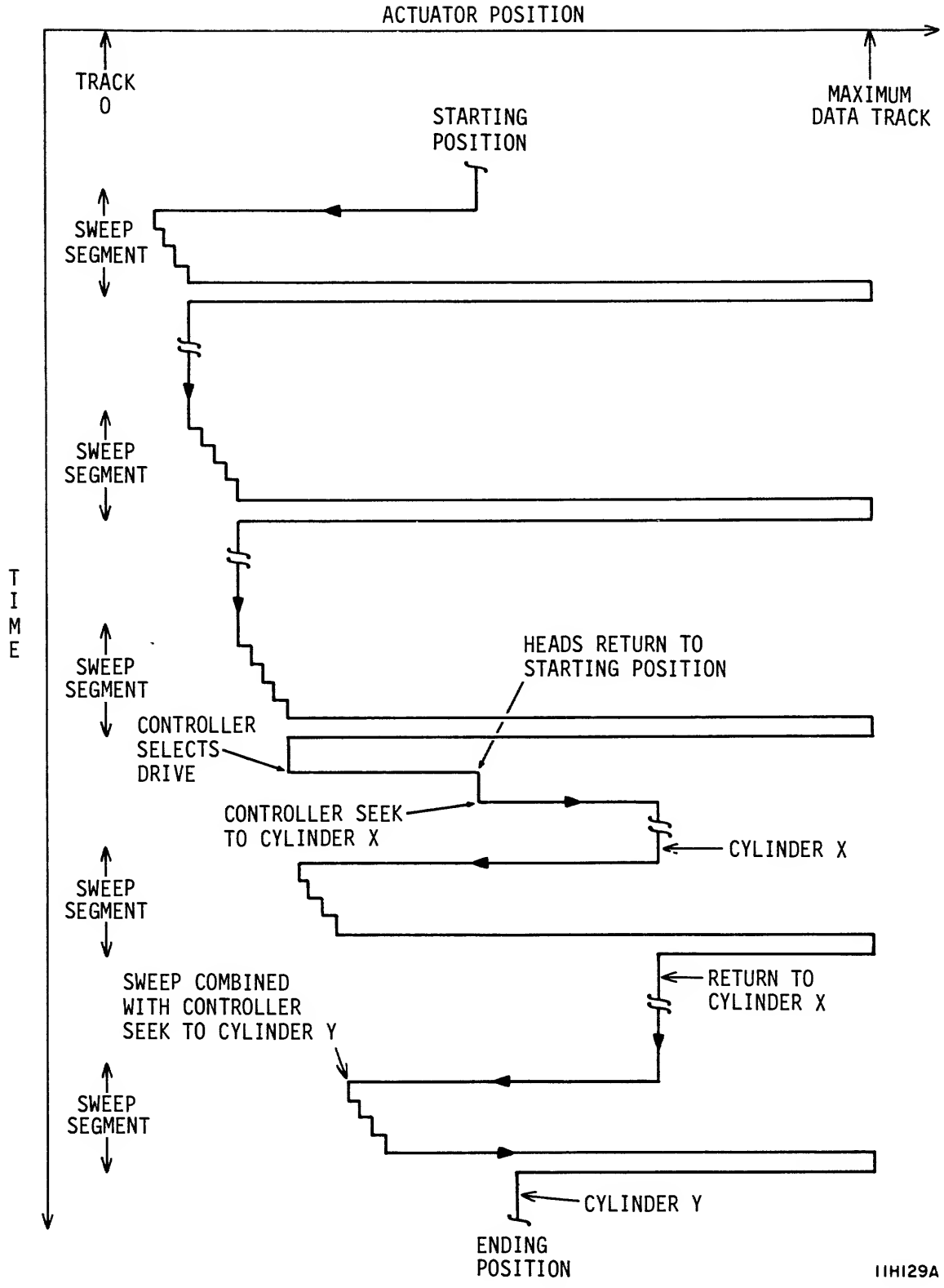

Figure 2-8. Typical Sweep Cycle Activity

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